NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE

No. 1182

A COLLECTION OF THE COLLAPSED RESULTS

OF GENERAL TANK TESTS OF MISCELLANEOUS

FLYING-BOAT-HULL MODELS

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Bureau of Aeronautics, Navy Department

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SUMMARY

This report presents summary charts of the collapsed results of general tank tests of about one hundred flying-boat-hull models. These summary charts are intended to be used as an engineering tool to enable a flying boat designer to grasp more quickly the significance of various hull form parameters as they influence his particular airplane. The form in which the charts are prepared is discussed in some detail in order to make them clearer to the designer.

This is a data report, but no attempt has been made to produce conclusions of the usual sort or correlations. However, some generalizations are put forward on the various methods in which the summary charts may be used.

INTRODUCTION

The increasing size of modern flying boats will no longer permit the designer to make a mistake. When flight tests of the first prototype show up some undesirable hydrodynamic characteristic, too much time and money are usually involved in attempting to correct it. The designer must, therefore, be given the tools whereby he may predict the performance of a proposed flying boat with reasonable accuracy.

In order to improve both the air and the water performance of future flying boats, there is imperative need of systematic design studies to determine the influence of the hull. It is hardly fair to expect the designer to wade through great masses of data in order to make these studies. He needs some simple, clear, and relatively accurate means of getting an over-all picture of the effect of various hull variables.

The usual forms of plotting the results of general tank tests are so complex that from 12 to 20 sheets of paper are often required to present the data for one hull model. Under these circumstances a long, laborious study is required to find out which is the better of the two hulls for a given purpose. The problem of finding the best of a group of hulls is practically unmanageable, both because of the work and because the method of presentation gives the designer no mental picture of the behavior of the models.

During the last 15 years or so general tank tests have been run on a very large number of hull models. This report presents the results of all the published NACA general tank tests, and some from the SIT and RAE tanks, in such form that they will be of immediate usefulness for design purposes. All the data for any one model are presented on a single summary chart which may be used to make either specific or general comparisons.

NOTATION

The test results are presented in terms of the standard NACA seaplane coefficients. Throughout this report the following notation and definitions are used:

Load coefficient	$C_\Delta = \Delta/wb^3$
Speed coefficient	$C_V = V/\sqrt{gb}$
Resistance coefficient	$C_R = R/wb^3$
Trimming-moment coefficient	$C_M = M/wb^4$
Longitudinal-spray coefficient	$C_X = X/b$
Lateral spray coefficient	$C_Y = Y/b$
Vertical-spray coefficient	$C_Z = Z/b$
Forebody length/beam ratio	L_f/b
Afterbody length/beam ratio	L_a/b
Step height/sternpost angle ratio	h/σ
Pitching "gyradius" constant	k/L

Aerodynamic pitch damping constant $\qquad M_q/V \frac{\rho w}{2} b^4$

where

Δ load on water, pounds

w   specific weight of water, pounds per cubic foot (62.3 for RAE and SIT, 63.5 for NACA, and 64.0 for sea water)

b   beam at main step, feet

V   speed, feet per second

g   acceleration of gravity (32.2 ft/sec^2)

R   resistance, pounds

M   trimming moment, pounds

X   longitudinal position of main-spray point of tangency, measured fore (positive) or aft (negative) of the step centroid, feet

Y   lateral position of main-spray point of tangency, measured from the hull centerline, feet

Z   vertical position of main-spray point of tangency, measured from the tangent to the forebody keel at the main step, feet

L_f forebody length, measured from the intersection of chine and keel to the step centroid along a line parallel to the tangent to the forebody keel at the main step, feet

L_a afterbody length, measured from the step centroid to the second step centroid or sternpost, whichever is shorter, feet

L   forebody plus afterbody lengths, feet

h   step height at the step centroid, percent of beam at step

σ sternpost angle, the angle between the tangent to the forebody keel at the main step and a line joining the tip of the step and the sternpost or second step, whichever is lower, degree

β_f forebody dead rise at keel and main step, degree

α afterbody angle, the angle between the forebody and afterbody
            keels, degree

β_a maximum afterbody dead rise regardless of where it occurs,
            degree

M_q aerodynamic tail damping derivative   (See reference 1 for com-
            plete definition.)

k pitching radius of gyration, feet

Moment data are referred to the center of gravity and water trim-
ming moments which tend to raise the bow are considered positive.

Trim (τ) is the angle between the tangent to the forebody keel
at the main step and the free water surface in all cases.

Heel (Φ) is the angle between the centerline plane of the hull
and a plane perpendicular to the still water surface.

The coordinates of the center of gravity are measured above the
tangent to the forebody keel at the main step and forward of a plane
perpendicular to the keel and passing through the step centroid. The
step centroid is the center of gravity of the area on the forebody
bounded by the tip of the step and a line joining the intersections of
the step faces with the chines.

The following combinations of the coefficients defined above are
used:

Planing Range

    Lift coefficient $\sqrt{C_\Delta}/C_V$ (reference 1)

    Resistance coefficient $\sqrt{C_R}/C_V$ (reference 2)

Displacement Range

    Speed coefficient $C_V^2/C_\Delta{}^{1/3}$ (reference 2)

    Resistance coefficient $C_R/C_V^2 C_\Delta{}^{2/3}$ (reference 2)

    Longitudinal-spray coefficient $C_X/C_\Delta{}^{1/3}$ (reference 3)

Lateral-spray coefficient $C_V/C_{\triangle}{}^{1/3}$ (reference 3)

Vertical-spray coefficient $C_Z/C_{\triangle}$ (reference 3)

The courtesy of the National Advisory Committee for Aeronautics in furnishing detailed test data on certain models which had not previously been published is deeply appreciated. It should be noted that the resistance and porpoising data on SIT models 294-79 and 406 were determined under the auspices of the Glenn L. Martin Company. The data on SIT models 618 and 621 were determined for the Grumman Aircraft Engineering Corporation in connection with a flying boat being developed for the U. S. Navy.

<p style="text-align:center">DEVELOPMENT OF CHART</p>

Figures 1 to 103, summary charts used to present the data shown in this report, are the result of a coordinated development program. It is of importance to the user of these charts to understand how they are laid out so that he can get the maximum benefit from them.

(a) Title box.-- At the top of the summary chart is information defining certain characteristics of the model and the test, which must be known before intelligent comparisons can be made between charts. With the exception of the designation they are believed to be self--explanatory. Very careful consideration was given to the definition of this designation. By itself, the designation will give a crude measure of what are, perhaps, the most important hydrodynamic characteristics of the hulls of modern flying boats. Thus, if a chart has the designation:

<p style="text-align:center">4.00 - 1.00 - 25.0</p>

it would mean $L_f/b - h/\sigma - \beta_f$

which, in turn, are a measure of   Spray Skipping Impact

A further advantage of this system of designating the hull is that each of the particular hydrodynamic characteristics improves as the number gets larger. Like most things in nature, however, changing the hull shape to improve one hydrodynamic characteristic may harm another. The designation system is therefore not foolproof and should be used with caution.

Background for the assumption that the forebody length/beam ratio controls the main spray of the hull may be found in references 4 and 5.

Both of these references show quite good correlation of the main-spray characteristics of existing flying boats in terms of forebody/length beam ratio. While it is undoubtedly quite true that other hull form variables have a powerful influence on the main spray characteristics, the forebody length/beam ratio appears to be the primary parameter. Reference 6 indicates that one of the most important hull form variables governing the skipping characteristics is the step height/sternpost angle ratio. Recent and as yet unpublished NACA tests indicate that the afterbody length has considerable influence on skipping, but other factors seem to have only secondary effects. It is generally accepted that forebody dead rise is the hull-shape parameter controlling the violence of the landing impact. Hence, it is believed that the parameters chosen are eminently suitable for a crude and quick evaluation of the potentialities of a particular hull.

No matter how clever a designation system is devised, it cannot hope to describe completely a shape as complex as a flying-boat hull. For this reason, to the right and just underneath the title box, is a simple body plan of the hull. This should materially aid the user of the summary chart in getting a quick picture of the shape under consideration.

A few other important dimensions and particulars of the hull models may be found in the tables on pages 12 to 14. These tables may also be used as an index of the summary charts included in this report. If any particular hull should prove to be of direct interest, it is strongly recommended that reference be made to the original reports. The tables also give the source of the data.

(b) Main spray data.-- The form in which the spray data is shown near the top of the chart was developed in reference 3. This method of plotting has the very powerful advantage of allowing direct comparisons between hulls, regardless of the loads at which the tests were made. A rather strong disadvantage is that the curves are not visibly related to the hull itself. One way to overcome this difficulty is to compare the height and lateral positions of the points of tangency of different models at the same longitudinal position. If it is expected to load the different hulls in different manners, care must be exercised. A comparison of this sort is only possible at all because of the fact that there is relatively little difference in the

$C_X/C_\Delta{}^{1/3}$ curves for the various hulls tried so far.

Plots shown in reference 3 may be used to make an estimate of the accuracy of this form of plotting through the scattering of test points.

(c) Displacement range resistance.- In the middle of the summary chart are shown the free-to-trim resistance and trim as determined in

the displacement range. This form of plotting was developed in refer-
ence 2 and was chosen in preference to that shown in figure 23 of refer-
ence 3 because it yields difinite clues to two other very important
hydrodynamic characteristics.

The bow spray in rough water (windshield wetting) is an exceedingly
important characteristic of military flying boats and a simple means for
evaluating it is very desirable. It appears that a reasonably reliable
criterion for evaluating bow spray is the peak of the curve of

$C_R/C_V^2 C_\Delta^{2/3}$. The peak occurs at values of $C_V^2/C_\Delta^{1/3}$ near 1.5, which
is in the vicinity of the speed at which bow spray is at its worst.
This peak should, under no circumstances, be confused with the true hump
which occurs much later. The peak in the $C_R/C_V^2 C_\Delta^{2/3}$ curve is caused
primarily by water piling up ahead of the bow. It therefore makes an ex-
cellent criterion for measuring the effectiveness with which the bow cuts
the water. The lower the peak the greater the ease with which the bow
cuts the water. Hence, by inference, it may be used as a measure of the
bow spray in rough water, which appears to be directly related to the
ease with which the bow cuts through waves. (See reference 7.)

With the lower power loadings coming into general use, it appears
that the free-to-trim trim is more important than the resistance. It
is hardly worth while doing much work to reduce the take-off time 10
percent if the time is already about 20 seconds; whereas it is important
if the time is near 60 seconds. On the other hand, if the trim is too
high or too low the spray is likely to be quite bad and, even though
its duration is short, it may do structural damage. The scale adopted
for trim is twice as large as that used in figure 23 of reference 3.
True, the resistance scale is much smaller in the vicinity of the hump
($C_V^2/C_\Delta^{1/3}$ between about 8 and 12), but it is believed to be large enough
for most practical purposes.

In references 2 and 8 will be found data, plotted in this manner,
which may be used to get an estimate of the accuracy to be expected
through the amount of scatter.

(d) Planing range.- In the planing range the results are presented
in the same manner as was developed in references 1 and 2. Contours of
the planing resistance coefficient $\sqrt{C_R}/C_V$ have been omitted where
they would be more than 2° or 3° outside of the limits of longitudinal
stability. Since there would not be much hope of being able to operate
a flying boat in this region of instability, regardless of how good the
resistance might be, omitting the data should avoid some confusion. An
exception is the region near get-away in which the hull is riding with
the forebody clear. Under this circumstance, the contours were prepared
whenever data was available.

In some cases contours of constant C_M are included — at least where it was not too time-consuming to dig them out of the original data. Actually, plotting C_M in this way is completely irrational. Constant C_M was used for two reasons: it works quite well (see data plots in references 1, 8, and 9), and it is simpler than the rational form $\sqrt{C_M}/C_V$.

The manner in which the various contours in the planing range were derived deserves careful attention at the low-speed end. At the higher values of the planing-lift coefficient, $\sqrt{C_\Delta}/C_V$, the collapsing process breaks down. The resistance at constant trim and trim at constant moment for specific values of C_Δ, peel off the main curves. Examples of this peeling-off process may be found in references 2 and 8. When the designer is preparing resistance or trim curves from the displacement and planing range, care should be taken to see that the curves from the two regimes overlap. The lower values from either regime should then be used. This matter is discussed in greater detail in reference 8. The peak of the lower limit sometimes, but not always, performs a similar peeling off. The breakdown of the collapsing process at the lower end of the planing range is regarded primarily as an inconvenience. It can be overcome by practice in using the charts and good judgment.

The accuracy of the various contours in the planing range may be judged by plots of data shown in references 1, 2, 8, and 9. The reason that no test points have been shown on any of the charts in this report is merely to avoid the confusion to the eye of a great mass of black spots.

One last point that deserves mention is that speed increases toward the right everywhere on the summary charts.

DISCUSSION

(a) Using the chart.- The crucial job in designing a flying boat is to ensure that the hull and air structure fit together as a single working unit to give both good air and water performance. Just as airplanes designed for different purposes require different wing and power loadings, so do hulls have to be custom-tailored for the particular jobs they are expected to perform.

The designer is badly hampered, when hull data is reported in the conventional manner, by the multiplicity of charts he has to wade through to select a hull suitable for the job he has in mind. The summary charts presented with this report should aid considerably in getting to the

root of the problem of selecting a suitable hull. Basically, there are
at least three methods for using these charts. Depending on the time and
staff available, best results will often be obtained by using a combina-
tion of all three methods.

The first and simplest method of using the summary charts is to
select those which contain hull form parameters of interest and spread
them out over a large table. By merely standing back and looking at the
group of charts the designer can readily pick out, without further ado,
those hulls having characteristics completely unsuitable for the job he
has in mind. This method is not very effective for finding the best
hull for a particular job, but what is very important is that it will
quickly get rid of the deadwood. It will be noted that this type of
analysis will be greatly facilitated by keeping the summary charts in
a loose-leaf binder when they are not in use.

Because of the job that the hull is expected to perform, certain of
the hydrodynamic characteristics will have predominating influence. The
criteria measuring these characteristics may be plotted against the con-
trolling hull-shape parameters. This process will undoubtedly show the
bow of one hull is best, the afterbody of another hull, and so on. This
should allow the designer to fit the various parts together to produce
a hull having the performance he wants, and at the same time he will
have quite a good idea of its characteristics. At this stage the
designer should undertake tank tests to get the specific characteristics
of his hull, if the importance of the project warrants the time and money.

The third method of using summary charts is actually to fit hulls
with satisfactory hydrodynamic characteristics to an airplane and deter-
mine the aerodynamic performance. A quick method of determining the
hydrodynamic characteristics for specific airplanes from the summary
charts will be found in reference 8. If the airplane is being designed
for maximum range, for instance, at the expense of other characteristics,
range may be plotted against various hull parameters. This type of
design study yields its clearest results when confined to a series of
hulls having some systematic change. Several such series will be found
in this report. Unfortunately, they are small families; however, in
the near future several more complete studies should be available.

(b) General.- The designer will undoubtedly be highly irritated
when he finds a hull with some one interesting characteristic, but the
data on the othere hyrodynamic characteristics missing. Unfortunately,
this is likely to happen quite frequently since, out of all the charts
included, only about half a dozen are complete. This disadvantage should
not weigh too heavily, however, because it is a relatively simple matter
to get the additional data necessary. Should such a hull or hulls turn
up, the designer should make his needs known.

In this connection, it is worth noting that the testing establishments would make a good deal faster progress if they deliberately left gaps in various types of data used in preparing a summary chart. For instance, as far as large military flying boats are concerned, present design trends seem to indicate that stability and spray are the controlling criteria. Work on these two characteristics, at the expense of others, would appear well worth while. When interesting hulls have been found it is very simple to go back and get the missing data.

As pointed out previously, the manner in which the displacement range resistance and trim is plotted was selected because it gave clues to the bow spray and main spray even though they were not actually tested. Similarly, the resistance contours in the planing range may be used as a clue to the upper limit porpoising and skipping characteristics. Ordinarily, the upper limit of porpoising may be expected to be about 1° below the line which shows where the forebody comes clear. Further, it will be reasonably parallel to it. This will locate the primary upper limit, but not the secondary upper limit.

At very low values of the planing lift coefficient and moderately high trims, the resistance contours frequently bend to the right. This bending is associated with afterbody wetting, and hence presumably may be taken as at least an indication of the skipping characteristics. On a few hulls the bending occurs quite suddenly, and it is expected that then skipping will be found only at trims above the lowest sharp bend.

The temptation to select some hull from this or other similar collections of summary charts as the final design should be strenuously resisted. Because a certain hull was satisfactory on some given design does not necessarily mean that it will be equally good for a new and different design. These charts should be regarded as an engineering tool for determining trends to arrive at a better hull. If kept in this light, no matter how closely they are pushed, no insuperable difficulties should arise from the use of the summary charts.

CONCLUDING REMARKS

The group of summary charts presented in this report should be a valuable tool to assist the designer in selecting a hull for a particular purpose. By using the charts and getting familiar with them, the designer will be able more quickly to arrive at the point of most interest to him — a high-performance aircraft.

Aviation Design Research Branch,
Bureau of Aeronautics, Navy Department,
    Washington, D. C., January 1946.

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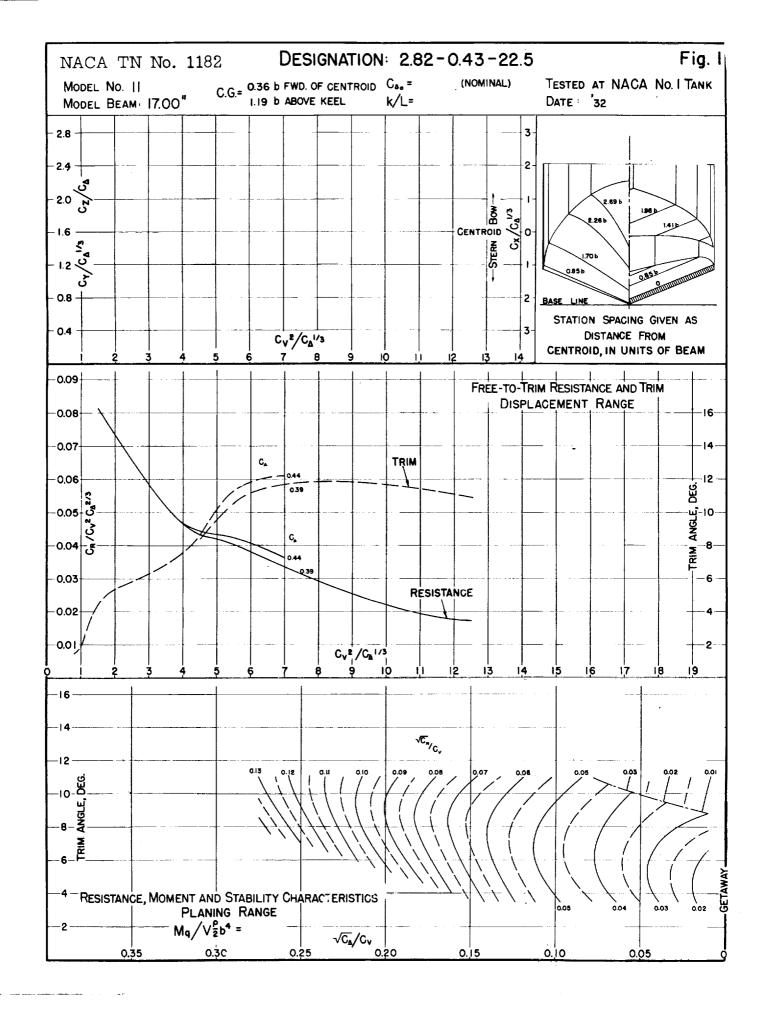
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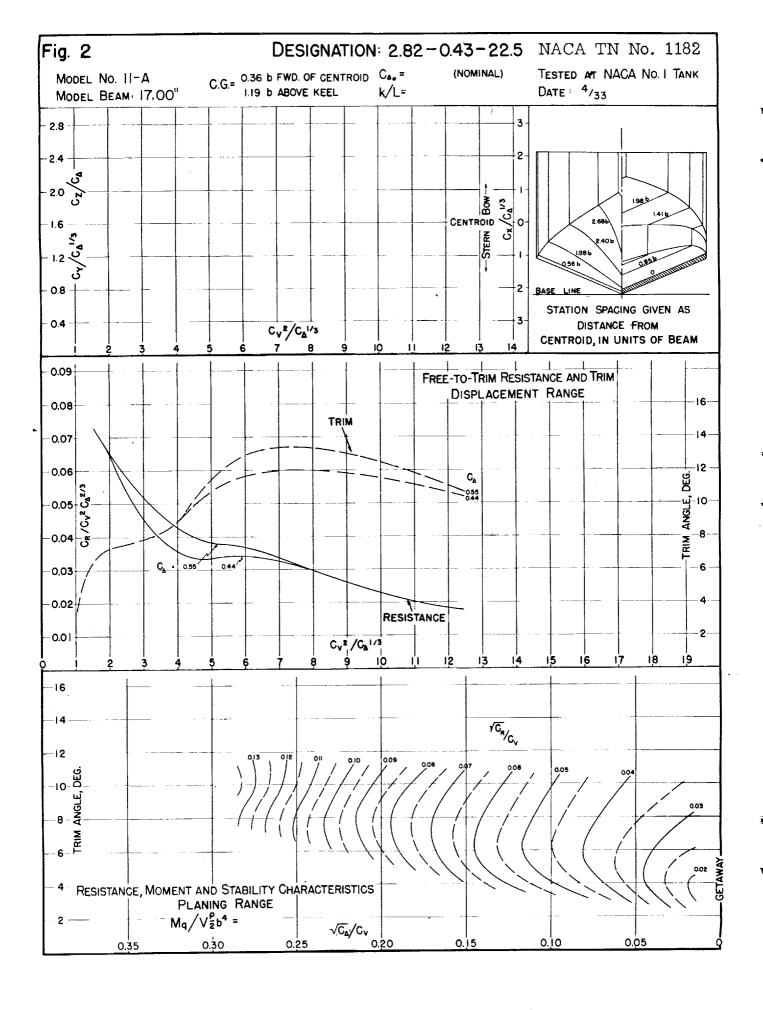
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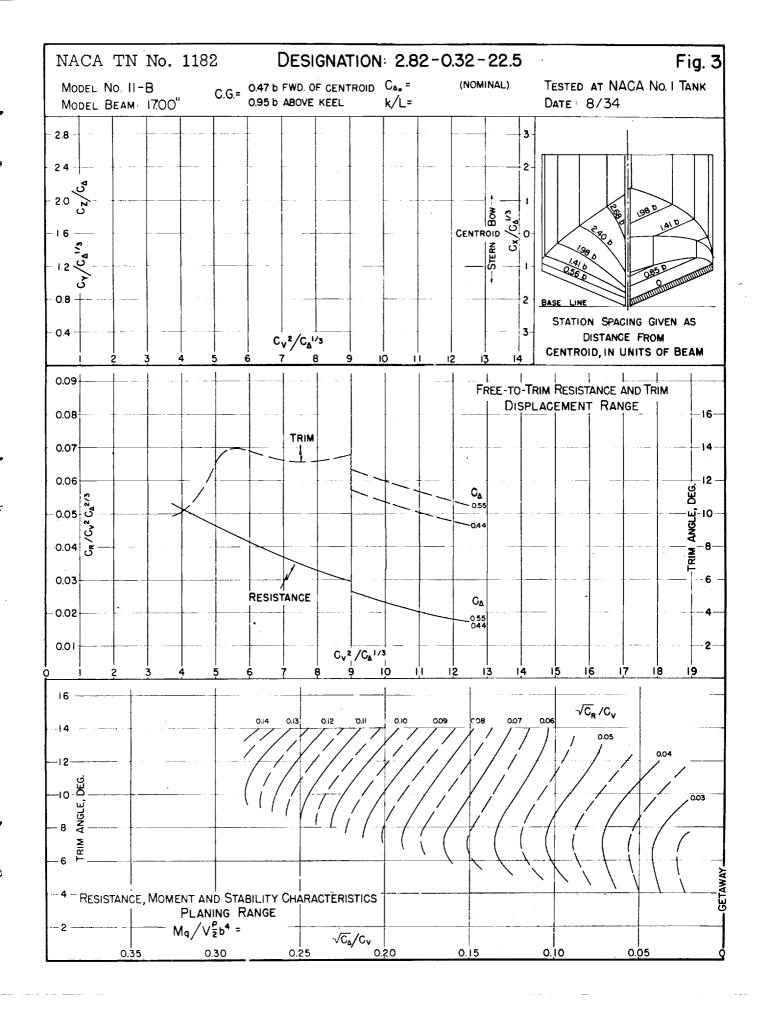
Model No.	Designation			L/b	La/b	Lf/L	h %b	α (deg)	σ (deg)	βamax	Center-of-gravity position		Model beam (in.)	Remarks	Source	Fig.
	Lf/b	h/σ	βf								fwd/b	above/b				
NACA MODELS																
11	2.82	0.43	22.5	4.47	1.65	0.630	3.31	6.5	7.63	22.5	0.36	1.19	17.00		TN 464	1
11-A	2.82	.43	22.5	4.47	1.65	.630	3.31	6.5	7.63	22.5	.36	1.19	17.00		TN 470	2
11-B	2.82	.32	22.5	4.47	1.65	.630	3.31	9.0	10.13	22.5	.47	.91	17.00	Longitudinally concave forebody	TN 545	3
11-C	2.82	.43	22.5	4.47	1.65	.630	3.31	6.5	7.63	22.5	.47	.91	17.00		TN 535	4
11-C-7	2.82	.76	22.5	4.47	1.65	.630	3.31	3.5	4.35	22.5	.47	.91	17.00		TN 541	5
11-C-8	2.82	.55	22.5	4.47	1.65	.630	3.31	5.0	6.00	22.5	.47	.91	17.00		TN 541	6
11-C-9	2.82	.36	22.5	4.47	1.65	.630	3.31	8.0	9.13	22.5	.47	.91	17.00		TN 541	7
11-C-10	2.82	.30	22.5	4.47	1.65	.630	3.31	10.0	11.10	22.5	.47	.91	17.00		TN 541	8
11-C-11	2.82	.11	22.5	4.47	1.65	.630	.74	6.5	6.73	22.5	.47	.91	17.00		TN 535	9
11-C-12	2.82	.26	22.5	4.47	1.65	.630	1.84	6.5	7.12	22.5	.47	.91	17.00		TN 535	10
11-C-13	2.92	.69	22.5	4.47	1.65	.630	5.88	6.5	8.50	22.5	.47	.91	17.00		TN 535	11
11-C-30° S	2.87	.61	22.5	4.47	1.60	.643	4.31	6.5	7.08	22.5	.52	.91	17.00	30° Swallow-tail step	TN 539	12
11-C-45° V	2.74	.27	22.5	4.47	1.73	.613	2.41	6.5	9.00	22.5	.39	.91	17.00	45° V-step	TN 539	13
11-E	2.52	.75	7.5	4.47	1.65	.630	5.76	6.5	7.63	22.5	.47	.91	17.00	Two longitudinal steps on forebody	TN 574	14
11-F	2.82	.75	14.8	4.47	1.65	.630	5.70	6.5	7.63	22.5	.47	.91	17.00	----do----	TN 574	15
11-G	2.82	.43	22.5	4.47	1.65	.630	3.31	6.5	7.63	22.5	.47	.91	17.00	Some chine flare on forebody	TN 531	16
11-M	2.82	.75	18.7	4.47	1.65	.630	5.76	6.5	7.63	22.5	.47	.91	17.00	One longitudinal step on forebody	TN 574	17
11-N	2.82	.75	7.5	4.47	1.65	.630	5.76	6.5	7.63	22.5	.47	.91	17.00	----do----	TN 574	18
12	3.00	.44	22.5	4.75	1.75	.630	3.31	6.5	7.57	22.5	.39	1.19	17.00		TN 491	19
13	2.64	.43	22.5	4.18	1.54	.630	3.31	6.5	7.73	22.5	.34	1.19	17.00		TN 491	20
14	2.52	.39	20.3	4.00	1.48	.630	2.95	6.5	7.63	20.3	.32	1.07	19.00		TN 491	21
15	3.20	.49	25.1	5.07	1.87	.630	3.73	6.5	7.63	25.1	.41	1.35	15.00		TN 491	22
16	2.44	.56	23.0	5.00	2.56	.488	4.85	8.0	8.65	20.0	0	1.03	15.42		TN 471	23
18	2.84	.51	22.5	4.67	1.83	.608	3.8	6.25	7.5	22.5	.49	.78	16.84	"Hook" on forebody at step	TN 681	24
22	2.12	2.88	10.0	4.47	2.36	.475	17.3	0	6.0	10.0	-.23	.80	17.00	Pointed step	TN 488	25
22-A	2.28	2.88	10.0	4.64	2.36	.492	17.3		6.0	10.0	0	.80	17.00		TN 504	26
26	2.75	.45	22.0	4.53	1.78	.607	3.2	6.55	7.03	22.0	.24	.82	17.86		TN 512	27
27	∞	∞	10.0							10.0			16.00	Planing surface	TN 509	28
28	∞	∞	10.0							10.0			16.00	----do----	TN 509	29
29	∞	∞	20.0							20.0			16.00	----do----	TN 509	30
30	∞	∞	30.0						6.0	20.0			16.00	----do----	TN 509	31
35	2.92	3.77	15.0	6.15	3.23	.475	22.6	0	6.0	15.0	.08	.97	13.00	Pointed step	TN 551	32
35-A	2.92	3.77	20.0	6.15	3.23	.475	22.6	0	6.0	20.0	.08	.97	13.00	----do----	TN 551	33
35-B	2.92	3.77	25.0	6.15	3.23	.475	22.6	0	6.0	25.0	.08	.97	13.00	----do----	TN 551	34
36	3.57	.55	20.0	5.71	2.14	.625	4.0	6.25	7.35	20.0	.71	1.00	14.00		TN 638	35
40-AC	3.12	.44	20.0	5.57	2.45	.560	3.7	7.5	8.5	20.0	.30	1.12	13.47		Rep. 543	36
40-AD	3.12	.44	20.0	5.57	2.45	.560	3.7	8.5	8.5	20.0	.30	1.12	13.47		Rep. 543	37
40-AE	3.12	.41	20.0	7.43	4.31	.420	3.7	8.5	9.1	20.0	.30	1.12	13.47		Rep. 543	38
40-BC	3.12	.44	20.0	5.57	2.45	.560	3.7	7.5	8.5	20.0	.30	1.12	13.47		Rep. 543	39
40-BE	3.12	.41	20.0	7.43	4.31	.420	3.7	8.5	9.1	20.0	.30	1.12	13.47		Rep. 543	40

Model No.	L_f/b	h/σ	β_f	L/b	L_{ea}/b	L_f/L	h/b %	α (deg)	σ (deg)	βa_{max}	C.G. fwd/b	C.G. above/b	Model beam (in.)	Remarks	Source	Fig.
NACA MODELS																
41-A	3.56	0.86	26.0	5.98	2.42	0.595	7.75	7.5	9.0	26.0	0.44	2.04	12.00		TN 563	41
41-D	3.58	.98	26.0	6.00	2.42	.597	7.75	6.0	7.9	26.0	.58	2.04	12.00		TN 656	42
44	2.76	.51	22.5	4.48	1.72	.616	3.1	5.0	6.1	22.5	.48	.97	17.00		TN 566	43
46	2.60	.98	-2.0	5.24	2.64	.497	6.8	4.6	6.92	24.0	0	.80	14.24		TN 635	44
47	2.38	.38	26.0	4.68	2.30	.509	3.45	8.0	9.0	25.0	.13	1.31	16.26		TN 590	45
52	2.76	.47	22.5	3.62	.86	.773	4.0	5.8	8.5	22.5	.44	.88	17.00		TN 576	46
57-A	3.37	.85	20.0	6.74	3.37	.500	6.8	7.0	8.25	20.0	.36	1.93	12.45		TN 716	47
57-B	3.37	.85	25.0	6.74	3.37	.500	6.8	7.0	8.25	25.0	.36	1.93	12.45		TN 716	48
57-B-5	4.17	.85	25.0	7.54	3.37	.555	6.8	7.0	8.25	25.0	.36	1.93	12.45		TN 716	49
57-C	3.37	.85	30.0	6.74	3.37	.500	6.8	7.0	8.25	30.0	.36	1.93	12.45		TN 716	50
61-A	3.73	4.09	26.0	6.70	2.97	.556	24.5	0	6.0	26.0	.45	2.04	12.00	Pointed step	TN 656	51
62-AD	2.82	.36	22.5	4.59	1.77	.615	3.3	9.0	9.15	22.5	.37	.91	17.00		TN 725	52
66	2.34	.47	25.0	4.49	2.15	.522	4.6	7.5	8.8	30.5	.08	.96	21.60	30° V-step	TN 858	53
73	3.73	4.09	26.0	6.70	2.97	.556	24.5	0	6.0	30.0	.45	2.04	12.00	Faired pointed step	TN 656	54
74-A	3.15	.26	R	5.24	2.09	.601	1.95	6.8	7.5	R	.45	.93	15.92	Circular bottom	TN 668	55
75	2.87	2.44	20.0	5.42	2.55	.530	19.5	1.5	8.0	20.0	.17	.98	15.90	Faired pointed step	TN 668	56
83	3.09	.63	25.0	4.58	1.49	.675	2.6	2.2	4.15	37.0	.42	.72	17.70		TN 836	57
84-AF	3.24	.34	20.0	5.38	2.14	.603	2.58	6.8	7.5	20.0	.46	1.16	15.92		ARR 3I15	58
84-EF-1	3.24	.34	20.0	5.38	2.14	.603	2.58	6.8	7.5	20.0	.46	1.16	15.92		ARR 3I15	59
84-EF-3	3.24	.57	20.0	5.38	2.14	.603	4.52	6.8	7.9	20.0	.46	1.16	15.92		ARR 3I15	60
84-EF-4	3.24	.47	20.0	5.38	2.14	.603	4.52	8.5	9.6	20.0	.46	1.16	15.92		ARR 3I15	61
126A-1	2.82	.88	17.5	5.04	2.22	.560	5.0	5.0	5.7	17.5	.31	1.17	14.00		ARR 3B23	62
126A-2	2.82	.58	17.5	5.04	2.22	.560	5.0	7.5	8.7	17.5	.31	1.17	14.00		ARR 3B23	63
126A-3	2.82	.47	17.5	5.04	2.22	.560	5.0	9.3	10.6	17.5	.31	1.17	14.00		ARR 3B23	64
126B-1	2.82	.88	22.5	5.04	2.22	.560	5.0	5.0	5.7	22.5	.31	1.17	14.00		ARR 3B23	65
126B-2	2.82	.58	22.5	5.04	2.22	.560	5.0	7.5	8.7	22.5	.31	1.17	14.00		ARR 3B23	66
126B-3	2.82	.47	22.5	5.04	2.22	.560	5.0	9.3	10.6	22.5	.31	1.17	14.00		ARR 3B23	67
126C-1	2.82	.88	27.5	5.04	2.22	.560	5.0	5.0	5.7	27.5	.31	1.17	14.00		ARR 3B23	68
126C-2	2.82	.58	27.5	5.04	2.22	.560	5.0	7.5	8.7	27.5	.31	1.17	14.00		ARR 3B23	69
126C-3	2.82	.47	27.5	5.04	2.22	.560	5.0	9.3	10.6	27.5	.31	1.17	14.00		ARR 3B23	70
144	3.14	.74	20.0	5.23	2.09	.601	6.28	6.8	8.45	20.0	.45	1.13	15.92		ARR 3J23	71
145	3.94	.85	20.0	6.54	2.60	.601	7.02	6.8	8.27	20.0	.51	1.26	14.24		ARR 3J23	72
146	4.71	.95	20.0	7.84	3.13	.601	7.70	6.8	8.14	20.0	.55	1.38	13.00		ARR 3J23	73
184	5.80	.66	20.0	10.50	4.70	.553	5.0	7.0	7.60	20.0	.46	1.40	11.81		ARR L5G19	74
185	5.80	.66	24.5	10.50	4.70	.553	5.0	7.0	7.60	24.5	.46	1.40	11.81		ARR L5G19	75
185-A	5.80	1.22	24.5	10.50	4.70	.553	10.0	7.0	8.20	24.5	.46	1.40	11.81	45° V-step	ARR L5G19	76
207	3.78	1.10	25.0	7.00	3.22	.540	9.0	8.3	9.90	35.0	.31	.83	14.74	With chine flare on afterbody	RMR L5H06a	77
207A	3.78	1.06	25.0	7.00	3.22	.540	9.0	8.3	9.57	35.0	.31	.83	14.74		RMR L5H06a	78
207C	3.76	1.06	25.0	7.00	3.22	.540	9.0	8.3	9.57	35.0	.31	.83	14.74	Chine lowered near bow	RMR L5H06a	79

Model No.	Designation			L/b	La/b	Lr/L	h/b %	α (deg)	σ (deg)	βe max	Center-of-gravity position		Model beam (in.)	Remarks	Source	Fig.
	Lf/b	h/σ	βf								fwd/b	above/b				
RAE MODELS																
L/b = 5.5	2.31	0.33	20.0	4.47	2.16	0.516	3.07	7.3	8.11	20.0	0.18	1.11	10.92		BA 1350	80
L/b = 7.0	2.94	.48	20.0	5.70	2.76	.516	3.91	7.3	8.11	20.0	.23	1.42	8.56		BA 1350	81
L/b = 8.5	3.57	.58	20.0	6.91	3.34	.516	4.75	7.3	8.11	20.0	.28	1.72	7.06		BA 1350	82
L/b = 10.5	4.20	.69	20.0	8.14	3.94	.516	5.58	7.3	8.11	20.0	.32	2.02	6.00		BA 1350	83
Shetland	3.69	1.06	27.0	7.29	3.67	.497	10.0	7.2	9.0	37.0	.24	1.32	7.17	Faired 24° V-step	Aero 1745	84
N2/42-A1	2.85	1.30	21.5	6.40	3.55	.445	11.0	6.5	8.5	26.0	.16	1.92	6.64	Faired transverse step	Aero 1858	85
N2/42-Q	2.87	1.11	20.0	6.40	3.53	.448	9.5	6.8	8.5	23.5	.16	1.95	6.56	----do------	Aero 1858	86
OEH	4.02	.98	27.5	8.28	4.26	.485	8.6	7.0	8.8	42.0	.10	1.29	6.58	Fully faired step	Aero 2029	87
FEH	4.02	1.09	27.5	8.28	4.26	.485	9.9	7.3	9.1	42.0	.10	1.29	6.58	Parabolic step	Aero 2029	88
SIT MODELS																
294-79	3.68	0.31	20.0	6.74	3.06	0.545	2.6	7.5	8.4	30.0	0.44	1.22	5.10		Unpublished	89
339-1	3.32	.62	20.0	6.07	2.75	.547	5.0	7.0	8.00	20.0	.35	.90	5.40		ARR 4F15	90
339-15	3.32	.64	20.0	6.57	3.25	.505	5.0	7.0	7.75	20.0	.35	.90	5.40		Unpublished	91
339-20	2.72	.62	20.0	5.47	2.75	.497	5.0	7.0	8.00	20.0	.35	.90	5.40		ARR 4F15	92
339-22	2.72	.61	20.0	4.97	2.25	.547	5.0	7.0	8.25	20.0	.35	.90	5.40		ARR 4F15	93
339-23	3.93	.64	20.0	7.18	3.25	.547	5.0	7.0	7.75	20.0	.35	.90	5.40		ARR 4F15	94
339-46	4.54	.67	20.0	8.29	3.75	.547	5.0	7.0	7.50	20.0	.35	.90	5.40		ARR 4F15	95
339-49	3.93	.67	20.0	7.68	3.75	.513	5.0	7.0	7.50	20.0	.35	.90	5.40		Unpublished	96
439-1	3.32	.62	20.0	6.07	2.75	.547	5.0	7.0	8.00	20.0	.43	.90	5.40		ARR 3K11	97
439-2	3.32	.62	10.0	6.07	2.75	.547	5.0	7.0	8.00	10.0	.43	.90	5.40		ARR 3K11	98
439-3	3.32	.62	30.0	6.07	2.75	.547	5.0	7.0	8.00	30.0	.43	.90	5.40	45° V-step	ARR 3K11	99
406	3.28	.59	20.0	6.02	2.74	.545	5.0	7.5	8.50	30.0	.37	1.10	5.45	Straight step	Unpublished	100
618-1	3.32	.73	20.0	5.76	2.44	.576	6.3	7.5	8.60	20.0	.39	1.05	5.40	Chine lowered fwd. afterbody warp	Unpublished	101
621-2	3.36	.87	20.0	6.12	2.76	.549	8.0	7.5	9.20	20.0	.40	1.05	5.40		Unpublished	102
621-8	3.36	.87	20.0	6.11	2.75	.550	8.0	7.5	9.20	27.0	.40	1.05	5.40		Unpublished	103

MODEL No. 11   C.G.= 0.36 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No. 1 TANK
MODEL BEAM: 17.00"   1.19 b ABOVE KEEL   k/L=   DATE: '32

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID
STERN — BOW
$C_V^2/C_\Delta^{1/3}$

2.69 b   1.96 b
2.26 b   1.41 b
1.70 b
0.85 b   0.85 b   0
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM ANGLE, DEG.

C_Δ
0.44
0.39
TRIM

C_Δ
0.44
0.39
RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.03 0.02 0.01

0.05 0.04 0.03 0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 2

DESIGNATION: 2.82-0.43-22.5 — NACA TN No. 1182

MODEL No. II-A
MODEL BEAM: 17.00"

C.G.= 0.36 b FWD. OF CENTROID
1.19 b ABOVE KEEL

C_{Δ_o} =   (NOMINAL)
k/L=

TESTED AT NACA No. I TANK
DATE: 4/33

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q/V\frac{\rho}{2}b^4 =$$

$$\sqrt{C_\Delta}/C_V$$

MODEL No. 11-B   C.G.= 0.47 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. 1 TANK
MODEL BEAM: 17.00"   0.95 b ABOVE KEEL   k/L=   DATE: 8/34

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.55
0.44

RESISTANCE

C_Δ
0.55
0.44

$C_V^2/C_\Delta^{1/3}$

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

Fig. 4

DESIGNATION: 2.82-0.43-22.5 NACA TN No. 1182

MODEL No. 11-C
MODEL BEAM 17.00"

C.G.= 0.47 b FWD. OF CENTROID $C_{\Delta_o} =$ (NOMINAL)
0.92 b ABOVE KEEL $k/L=$

TESTED AT NACA No.1 TANK
DATE 7/34

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.55
0.44

RESISTANCE

C_Δ
0.55
0.44

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

NACA TN No. 1182 — DESIGNATION: 2.82-0.76-22.5 — Fig. 5

Model No. 11-C-7
Model Beam: 17.00"
C.G.= 0.47 b FWD. OF CENTROID C_{Δ_0} = (NOMINAL)
0.91 b ABOVE KEEL k/L =
Tested at NACA No. 1 Tank
Date:

Station Spacing given as distance from centroid, in units of beam

Free-to-Trim Resistance and Trim — Displacement Range

Resistance, Moment and Stability Characteristics — Planing Range
$M_q / V \frac{\rho}{2} b^4$ =

Fig. 6

DESIGNATION: 2.82-0.55-22.5

NACA TN No. 1182

MODEL NO. 11-C-8
MODEL BEAM: 17.00"

C.G.= 0.47 b FWD. OF CENTROID $C_{\Delta_0} =$
0.91 b ABOVE KEEL $k/L =$

(NOMINAL)

TESTED AT NACA No.1 TANK
DATE: '34

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V^2 \frac{\rho}{2} b^4 =$

GETAWAY

MODEL No. 1i-C-9   C.G.=   0.47 b FWD. OF CENTROID $C_{\Delta_o} =$ (NOMINAL)   TESTED AT NACA No.1 TANK

MODEL BEAM 17.00"   0.91 b ABOVE KEEL   k/L=   DATE: '34

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID ← BOW

STERN →

$C_V^2/C_\Delta^{1/3}$

2.8   2.4   2.0   1.6   1.2   0.8   0.4

3   2   1   0   1   2   3

2 3 4 5 6 7 8 9 10 11 12 13 14

CENTROID

1.98 b   1.41 b   2.68 b   2.40 b   1.98 b   0.85 b   0.55 b   0

BASE LINE

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ 0.55   0.44

C_Δ 0.55   0.44

RESISTANCE

TRIM ANGLE, DEG.

0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01

16 14 12 10 8 6 4 2

$C_V^2/C_\Delta^{1/3}$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

TRIM ANGLE, DEG.

16 14 12 10 8 6 4 2

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

GETAWAY

MODEL No. 11-C-10   C.G.= 0.47 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. 1 TANK

MODEL BEAM: 17.00"   0.91 b ABOVE KEEL   k/L=   DATE : '34

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE

$$M_q / V \frac{\rho}{2} b^4 =$$

MODEL No. 11-C-11   C.G.= 0.47 b FWD. OF CENTROID $C_{\Delta_0}=$ (NOMINAL)   TESTED AT NACA No. 1 TANK
MODEL BEAM: 17.00"   0.91 b ABOVE KEEL $k/L=$ DATE: '34

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q/V\frac{\rho}{2}b^4 =$$

Fig. 10 — DESIGNATION: 2.82-0.26-22.5 — NACA TN No. 1182

MODEL No. 11-C-12   C.G.= 0.47 b FWD. OF CENTROID C_{Δ_o} = (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM 17.00"   0.91 b ABOVE KEEL   k/L=   DATE:

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V \frac{\rho}{2} b^4 =$

MODEL No. 11-C-13   C.G.= 0.47 b FWD. OF CENTROID $C_{\Delta_o}=$ (NOMINAL)   TESTED AT NACA No. 1 TANK

MODEL BEAM 17.00"   0.91 b ABOVE KEEL $k/L=$ DATE '34

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID

STERN — BOW

$C_V^2/C_\Delta^{1/3}$

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ
0.55
0.44

C_Δ
0.55
0.44

RESISTANCE

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

Fig. 12

DESIGNATION: 2.87 – 0.61 – 22.5

NACA TN No. 1182

MODEL No. II-C-30°S
MODEL BEAM: 17.00"

C.G. = 0.52 b FWD. OF CENTROID
0.91 b ABOVE KEEL

$C_{\Delta_0} =$
$k/L =$

(NOMINAL)

TESTED AT NACA No.I TANK
DATE: '35

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.55
0.44

C_Δ
0.55
0.44

RESISTANCE

$C_R/C_V^2 C_\Delta^{2/3}$

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03

TRIM ANGLE, DEG.

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

MODEL No. II-C-45°V　C.G.= 0.39 b FWD. OF CENTROID　C_{b_o} =　(NOMINAL)　TESTED AT NACA No. I TANK
MODEL BEAM: 17.00"　　0.91 b ABOVE KEEL　k/L=　　DATE: '35

45° V-STEP

2.06 b
2.60 b　1.49 b
2.32 b
1.90 b
0.48 b　0.93 b　0.08 b
BASE LINE

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$

2.8
2.4
2.0
1.6
1.2
0.8
0.4

CENTROID
STERN　BOW
$C_X/C_\Delta^{1/3}$
3
2
1
0
1
2
3

$C_V^2/C_\Delta^{1/3}$
1　2　3　4　5　6　7　8　9　10　11　12　13　14

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01

TRIM
C_Δ
0.55
0.44
C_Δ
0.55
0.44
RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.
16
14
12
10
8
6
4
2

O　1　2　3　4　5　6　7　8　9　10　11　12　13　14　15　16　17　18　19

TRIM ANGLE, DEG.
16
14
12
10
8
6
4
2

$\sqrt{C_R}/C_V$

0.15　0.14　0.13　0.12　0.11　0.10　0.09　0.08　0.07　0.06　0.05　0.04　0.03　0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

0.35　0.30　0.25　0.20　0.15　0.10　0.05　0

Fig. 14

DESIGNATION: 2.66 - 0.75 - 7.5   NACA TN No. 1182

MODEL No. 11-E
MODEL BEAM: 17.00"   C.G.= 0.47 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No. 1 TANK
0.92 b ABOVE KEEL   k/L =   DATE: 3/35

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STEP BOW

STERN

BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.55
0.44

$C_R/C_V^2 C_\Delta^{2/3}$

RESISTANCE

C_Δ = 0.55
0.44

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4$ =

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.15 0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

GETAWAY

MODEL No. 11-F   C.G.=   0.47 b FWD. OF CENTROID $C_{\Delta_0} =$ (NOMINAL)   TESTED AT NACA No.1 TANK

MODEL BEAM 17.00"   0.92 b ABOVE KEEL $k/L=$ DATE: 4/35

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q / V\frac{\rho}{2}b^4 =$$

Fig. 16
DESIGNATION: 2.82-0.43-22.5   NACA TN No. 1182

MODEL No. 11-G
MODEL BEAM 17.00"   C.G.= 0.47 b FWD. OF CENTROID C_{δ_o} =   (NOMINAL)
0.91 b ABOVE KEEL   k/L=

TESTED AT NACA No. I TANK
DATE: $^8/_{34}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V_{\frac{1}{2}}^{\rho} b^4 =$

MODEL No. 11-M   C.G.= 0.47 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 17.00"   0.92 b ABOVE KEEL   k/L=   DATE: 10/35

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4$ =

Fig. 18

DESIGNATION: 2.82-0.75-22.5   NACA TN No. 1182

MODEL No. 11-N
MODEL BEAM: 17.00"

C.G.= 0.47 b FWD. OF CENTROID
0.92 b ABOVE KEEL

$C_{\Delta_0} =$
$k/L =$

(NOMINAL)

TESTED AT NACA No.1 TANK
DATE: 11/35

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$\frac{C_Z/C_\Delta}{C_V/C_\Delta^{1/3}}$ $C_V^2/C_\Delta^{1/3}$ $C_X/C_\Delta^{1/3}$ CENTROID   STERN   BOW

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ 0.55
0.44

C_Δ 0.55
0.44

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 $\sqrt{C_R}/C_V$ 0.06 FOREBODY CLEAR 0.05 0.04 0.03 0.02

0.065 0.060 0.055

0.06

0.05 0.04 0.03 0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 12   C.G.= 0.39 b FWD. OF CENTROID C_{δ_o} =   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 17.00"   1.19 b ABOVE KEEL   k/L=   DATE: '33

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID $C_X/C_\Delta^{1/3}$

STERN   BOW

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

2.85 b   2.10 b
2.40 b   1.50 b
1.81 b
0.90 b   0.90 b
BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.40

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ = 0.39   0.44

RESISTANCE

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.12   0.11   0.10   0.09   0.08   0.07   0.06   FOREBODY CLEAR   0.03   0.02   0.01

0.06   0.05   0.04   0.03   0.02

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

GETAWAY

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 20   DESIGNATION: 2.64-0.43-22.5   NACA TN No. 1182

MODEL No. 13   C.G.= 0.34 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. 1 TANK
MODEL BEAM: 17.00"   1.19 b ABOVE KEEL k/L =   DATE: '33

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID ← STERN   BOW →

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

2.516   1.86 b
2.12 b   1.32 b
1.60 b
0.80 b   0.80 b
BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM ANGLE, DEG.

TRIM

C_Δ
0.4

RESISTANCE

0.4

$C_V^2/C_\Delta^{1/3}$

0.12 0.11 0.10 0.09 0.08   0.07   0.06   0.05   0.04   0.03

0.02

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 14   C.G.= 0.32 b FWD. OF CENTROID $C_{\Delta_o}=$ (NOMINAL)   TESTED AT NACA No.1 TANK

MODEL BEAM: 19.00"   1.07 b ABOVE KEEL   k/L=   DATE: '33

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ 0.42

C_Δ 0.42 0.37 0.30

TRIM

C_Δ 0.37 0.30   RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.12   0.11   0.10   0.09   0.08   0.07   0.06   0.05   0.03   0.02

0.05   0.04   0.03   0.02

GETAWAY

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

$C_V/C_\Delta^{1/3}$ $C_V^2/C_\Delta^{1/3}$ $C_X/C_\Delta^{1/3}$

CENTROID   BOW   STERN

2.40 b   1.77 b   2.02 b   1.26 b   1.52 b   0.76 b   0.76 b   0

BASE LINE

Fig. 22

DESIGNATION: 3.20 - 0.49 - 25.1

NACA TN No. 1182

MODEL No. 15
MODEL BEAM: 15.00"

C.G.= 0.41 b FWD. OF CENTROID
1.35 b ABOVE KEEL

$C_{\Delta_0} =$ (NOMINAL)
$k/L =$

TESTED AT NACA No. 1 TANK
DATE: '33

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

C_Δ : 0.65, 0.56, 0.48, 0.40

$C_V{}^2/C_\Delta{}^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q / V\tfrac{\rho}{2} b^4 =$$

$\sqrt{C_R}/C_V$

$\sqrt{C_\Delta}/C_V$

GETAWAY

MODEL No. 16   C.G.=   O b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No.1 TANK

MODEL BEAM 15.42"   1.03 b ABOVE KEEL k/L =   DATE: $^{12}/_{32}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

$\sqrt{C_R}/C_V$

FOREBODY CLEAR

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 24 — DESIGNATION: 2.84-0.51-22.5 — NACA TN No. 1182

MODEL No. 18
MODEL BEAM: 16.84"

C.G.= 0.49b FWD. OF STEP
0.78b ABOVE KEEL

C_{Δ_0} = 0.60 (NOMINAL)
k/L=

TESTED AT NACA No. 1 TANK
DATE: 10/37

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

MARTIN P3M-1

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

MODEL No. 22   C.G.= -0.23 b FWD. OF CENTROID $C_{\Delta_0}=$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 17.00"   0.80 b ABOVE KEEL $k/L=$ DATE: $7/33$

POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_V^2/C_\Delta^{1/3}$

C_Δ

TRIM

C_Δ

RESISTANCE

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V^{\frac{\rho}{2}}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 26

DESIGNATION: 2.28 – 2.88 – 10.0 NACA TN No. 1182

MODEL NO. 22-A
MODEL BEAM: 17.00"

C.G.= 0 b FWD. OF CENTROID
0.80 b ABOVE KEEL

$C_{\delta_o}=$
$k/L=$

(NOMINAL)

TESTED AT NACA No.I TANK
DATE: $^{11}/_{33}$

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STERN — BOW

CENTROID

$C_X/C_\Delta^{1/3}$

POINTED STEP

2.35 b
1.27 b
0.42 b
2.14 b
1.86 b
1.43 b
0.412 b

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE

TRIM

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ
0.55
0.44
0.33

C_Δ
0.55
0.44
0.33

$C_V^2/C_\Delta^{1/3}=$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{v}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 26
MODEL BEAM: 17.86"

C.G.= 0.24 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)
0.82 b ABOVE KEEL   k/L=

TESTED AT NACA No.1 TANK
DATE: 6/34

C_Z/C_Δ

$C_Y/C_\Delta{}^{1/3}$

$C_V{}^2/C_\Delta{}^{1/3}$

CENTROID $C_X/C_\Delta{}^{1/3}$

STERN   BOW

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

BASE LINE

2.75 b   2.59 b
2.46 b   1.78 b
1.99 b   0.94 b

SIKORSKY S-40

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V{}^2 C_\Delta{}^{2/3}$

TRIM

C_Δ
0.48
0.38
0.29

C_Δ
0.58

C_Δ= 0.48   0.38   0.29

RESISTANCE

$C_V{}^2/C_\Delta{}^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.14   0.13   0.12   0.11   0.10   0.09   0.08 $\sqrt{C_R}/C_V$ 0.07   0.06   0.05   0.04   0.03

$\sqrt{C_\Delta}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

0.35   0.30   0.25   0.20   0.15   0.10   0.05

GETAWAY

Fig. 28　　DESIGNATION: ∞ - ∞ - 0.0　　NACA TN No. 1182

MODEL No. 27　　C.G.=　　b FWD. OF CENTROID　$C_{\Delta_0} =$　　(NOMINAL)　　TESTED AT NACA No. I TANK
MODEL BEAM· 16.00"　　　　b ABOVE KEEL　$k/L =$　　　　　　　　DATE : '34

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID ← BOW

STERN →

$C_X/C_\Delta^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V =$

0.12　0.11　0.10　0.09　0.08　0.07　0.06　0.05　0.04　0.03　0.02　0.01

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35　　0.30　　0.25　　0.20　　0.15　　0.10　　0.05

MODEL No. 28   C.G.=   b FWD. OF CENTROID $C_{\Delta_0} =$ (NOMINAL)   TESTED AT NACA No. I TANK

MODEL BEAM 16.00"   b ABOVE KEEL   k/L=   DATE: '34

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q / V \frac{\rho}{2} b^4 =$$

Fig. 30   DESIGNATION: ∞ – ∞ – 20.0   NACA TN No. 1182

MODEL No. 29   C.G.=   b FWD. OF CENTROID   C$_{\Delta_0}$=   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 16.00"   b ABOVE KEEL   k/L=   DATE: '34

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID

STERN ← → BOW

$C_X/C_\Delta^{1/3}$

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$C_R/C_V^2\,C_\Delta^{2/3}$

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

$\sqrt{C_R}/C_V$

0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01

TRIM ANGLE, DEG.

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 30   C.G.=   b FWD. OF CENTROID $C_{\Delta_0} =$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 16.00"   b ABOVE KEEL   k/L=   DATE: '34

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q / V \tfrac{\rho}{2} b^4 =$$

MODEL No. 35   C.G.= 0.08 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 13.00"   0.97 b ABOVE KEEL   k/L=   DATE: 35

POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$$M_q / V \tfrac{\rho}{2} b^4 =$$

MODEL No. 35-A
MODEL BEAM 13.00"

C.G.= 0.08 b FWD. OF CENTROID
0.97 b ABOVE KEEL

C_{Δ_0} =
k/L=

(NOMINAL)

TESTED AT NACA No.1 TANK
DATE: 35

POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$C_Y/C_\Delta^{1/3}$ C_Z/C_Δ $C_V^2/C_\Delta^{1/3}$ $C_X/C_\Delta^{1/3}$

CENTROID — BOW
STERN — BOW

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
1.23
0.99
0.74

C_Δ =1.48
1.23

$C_R/C_V^2 C_\Delta^{2/3}$

RESISTANCE

C_Δ
1.23
0.99
0.74

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.18 0.17 0.16 0.15 0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 $\sqrt{C_R}/C_V$ 0.05 0.04 0.03 0.02

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 34

DESIGNATION: 2.93-3.77-25.0

NACA TN No. 1182

MODEL NO. 35-B
MODEL BEAM 13.00"

C.G.= 0.08b FWD. OF CENTROID
0.97b ABOVE KEEL

C_{Δ_0} =
k/L =

(NOMINAL)

TESTED AT NACA NO.1 TANK
DATE: 35

POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID — STERN BOW

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ
1.48
1.23
0.99

$C_\Delta = 0.74$

TRIM

C_Δ
1.23
0.99
0.74

C_Δ
1.23
0.99

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.17 0.16 0.15 0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

MODEL No. 36   C.G.=   0.71 b FWD. OF CENTROID $C_{\Delta_o} =$ (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM: 14.00"   1.00 b ABOVE KEEL   k/L=.   DATE: 3/36

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

Fig. 36

DESIGNATION: 3.12-0.44-20.0 NACA TN No. 1182

MODEL No. 40AC
MODEL BEAM: 13.47"

C.G.= 0.30b FWD. OF STEP
1.16 b ABOVE KEEL

$C_{\Delta_o} =$ (NOMINAL)
$k/L =$

TESTED AT NACA No.1 TANK
DATE: 5-25-34

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

MODEL NO. 40-AD   C.G.= 0.30 b FWD. OF STEP $C_{\Delta_0}=$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 13.47"   1.15 b ABOVE KEEL   k/L=   DATE: 6/34

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
1.1
0.9
0.7
0.5

RESISTANCE

C_Δ
1.1
0.9
0.7
0.5

$\sqrt{C_R}/C_V$

0.15   0.14   0.13   0.12   0.11   0.10   0.09   0.08   0.07   0.06   0.05   0.04   0.03

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

$\sqrt{C_\Delta}/C_V$

MODEL No. 40-AE   C.G.= 0.30 b FWD. OF STEP $C_{\Delta_0}=$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 13.47"   1.15 b ABOVE KEEL $k/L=$ DATE: 6 / 34

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STEP BOW
STERN BOW
STEP

$C_X/C_\Delta^{1/3}$

3.94 b   3.04 b
2.82 b   2.81 b
1.87 b
0.94 b
0
2.18 b
1.25 b
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

RESISTANCE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

C_Δ
1.1
0.9
0.7
0.5

TRIM

C_Δ
0.9
0.7
0.5

$C_R/C_V^2 C_\Delta^{2/3}$

$C_\Delta=1.1$

$C_\Delta=1.1$

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.15   0.14   0.13   0.12   0.11   0.10   0.09   0.08 $\sqrt{C_R}/C_V$ 0.07   0.06   0.05   0.04   0.03

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4 =$ $\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05   0

MODEL No. 40-BC   C.G.= 0.30 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No.1 TANK

MODEL BEAM· 13.47"   1.15 b ABOVE KEEL   k/L=   DATE : 5/34

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4 =$

Fig. 40

DESIGNATION: 3.12-0.41-20.0 NACA TN No. 1182

MODEL No. 40-BE
MODEL BEAM: 13.47" C.G.= 0.30 b FWD. OF STEP $C_{\Delta_o} =$ (NOMINAL)   TESTED AT NACA No.1 TANK
1.15 b ABOVE KEEL $k/L=$ DATE: 5/34

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

MODEL No. 41-A   C.G.= 0.44 b FWD. OF CENTROID C_{Δ_0} = 1.40   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 12.00"   2.04 b ABOVE KEEL   k/L=   DATE: 8/35

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

Fig. 42   DESIGNATION: 3.58 - 0.98 - 26.0   NACA TN No. 1182

MODEL No. 41-D
MODEL BEAM: 12.00"

C.G. = 0.58 b FWD. OF CENTROID
2.04 b ABOVE KEEL

C_{Δ_o} = 1.40   (NOMINAL)
k/L =

TESTED AT NACA No. 1 TANK
DATE: 4/36

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4$ =

Model No. 44
Model Beam: 17.00"   C.G.= 0.48 b FWD. OF STEP C_{Δ_o} = 0.44   (NOMINAL)   Tested at NACA No.1 Tank
0.97 b ABOVE KEEL   k/L=   Date: 6/35

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

$\leftarrow$ STERN   BOW $\rightarrow$

STEP

$C_V^2/C_\Delta^{1/3}$

2.71 b
2.66 b
2.56 b
2.16 b
0.84 b
1.44 b
1.76 b
0.96 b
0
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

CURTISS NC-4

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

C_Δ
0.55
0.44
0.33

RESISTANCE

C_Δ
0.55
0.44
0.33

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$C_M = 0$

0.14   0.13   0.12
0.11
0.10
0.09
0.08
$\sqrt{C_R}/C_V$
0.07
0.06
0.05
0.04

0.03

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05   0

Fig. 44

DESIGNATION: 2.60-0.98--2.0 NACA TN No. 1182

MODEL No. 46
MODEL BEAM: 14.24"

C.G.= 0 b FWD. OF STEP
0.80 b ABOVE KEEL

C_{Δ_o} = 0.75 (NOMINAL)
k/L=

TESTED AT NACA No.1 TANK
DATE: 2 / 35

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

STEP

STERN

BOW

1.58 b
2.10 b
2.44 b
2.37 b
2.09 b
1.89 b
1.43 b
0.80 b
0.63 b

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

SAVOIA S-55-X

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.93
0.74
0.56
0.37

RESISTANCE

C_Δ
0.93 0.74
0.56
0.37

$C_R/C_V^2 C_\Delta^{2/3}$

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

$C_M = 0$

$\sqrt{C_R}/C_V$

0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V \frac{\rho}{2} b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 47   C.G.= 0.13 b FWD. OF STEP C_{Δ_0} = 0.35 (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 16.26"   1.31 b ABOVE KEEL   k/L =   DATE: 10/35

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

SHORT CALCUTTA

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

Fig. 46 DESIGNATION: 2.76-0.47-22.5 NACA TN No. 1182

MODEL No. 52
MODEL BEAM: 17.00"
C.G.= 0.44 b FWD. OF CENTROID
0.91 b ABOVE KEEL
C_{Δ_0} = 0.46 (NOMINAL)
k/L=
TESTED AT NACA No.1 TANK
DATE: 6/35

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

BOEING PB-1

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE

$M_q / V \frac{\rho}{2} b^4 =$

MODEL No. 57-A   C.G.= 0.36 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No I TANK
MODEL BEAM 12.45"   1.93 b ABOVE KEEL   k/L =   DATE: $^6/_{38}$

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$
$C_X/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$

CENTROID — BOW
STERN

329 b
338 b
304 b
169 b
236 b
135 b
0
0
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

C_Δ
1.8
1.5
1.2
0.9

TRIM C_Δ
1.8
1.5
1.2
0.9

$C_R/C_V^2 C_\Delta^{2/3}$

RESISTANCE

$C_V^2/C_\Delta^{1/3}$ =

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

C_M = -0.4
0
+0.4

FOREBODY CLEAR

0.06   0.05   0.04   0.03

0.16   0.15   0.14   0.13   0.12   0.11   0.10   0.09

$\sqrt{C_R}/C_V$

0.08   0.07   0.06   0.05   0.04   0.03

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 48 — DESIGNATION: 3.38-0.85-25.0 NACA TN No. 1182

MODEL No. 57-B
MODEL BEAM: 12.45"
C.G.= 0.36 b FWD. OF STEP
1.93 b ABOVE KEEL
$C_{\Delta_0} =$ (NOMINAL)
$k/L =$
TESTED AT NACA No.1 TANK
DATE: 5/38

MODEL No. 57-B-5
MODEL BEAM: 12.45"

C.G.= 0.36 b FWD. OF CENTROID
1.93 b ABOVE KEEL

$C_{b_0} =$ (NOMINAL)
$k/L =$

TESTED AT NACA No.1 TANK
DATE: 7/38

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID
STERN BOW

$C_X/C_\Delta^{1/3}$

4.07 b
3.38 b
3.58 b
1.69 b
3.04 b
2.36 b
1.35 b
0
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ
1.8
1.5
1.2
0.9

C_Δ 1.8
1.5
1.2
0.9

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

PLANING RANGE
PRACTICALLY THE SAME AS
MODEL 57-B

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35　　0.30　　0.25　　0.20　　0.15　　0.10　　0.05　　0

Fig. 50   DESIGNATION: 3.37 - 0.85 - 30.0   NACA TN No. 1182

MODEL No. 57-C   C.G.= 0.36 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM: 12.45"   1.93 b ABOVE KEEL   k/L =   DATE: 6/38

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4$ =

MODEL No. 61-A
MODEL BEAM: 12.00"

C.G.= 0.45 b FWD. OF STEP
     2.03 b ABOVE KEEL

$C_{\Delta_o} =$
$k/L =$

(NOMINAL)

TESTED AT NACA No. 1 TANK
DATE: 8/36

POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

STEP

STERN   BOW

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
1.8
1.5
1.2
0.9
0.6

$C_R/C_V^2 C_\Delta^{2/3}$

$C_\Delta = 0.6$
0.9
1.2

$C_\Delta =$ 1.8 1.5 1.2

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$C_M = 0$ -0.2

FOREBODY CLEAR
0.03
0.02

0.16   0.15
0.14
0.13
0.12
$\sqrt{C_R}/C_V$
0.11
0.10
0.09
0.08
0.07   0.06   0.05   0.04   0.03
0.02
0.02

GETAWAY

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

$\sqrt{C_\Delta}/C_V$

Fig. 52   DESIGNATION: 2.82-0.36-22.5 NACA TN No. 1182

MODEL NO. 62-AD   C.G.= 0.37 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 17.00"   0.91 b ABOVE KEEL   k/L=   DATE: 10/38

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

MODEL NO. 66　　　　　　　　　　0.08 b FWD. OF CENTROID　C_{Δ_0} = 0.32　(NOMINAL)　TESTED AT NACA No.1 TANK
MODEL BEAM 21.60"　C.G.=　0.96 b ABOVE KEEL　　k/L =　　　　　　　　　　DATE:　36

V-STEP

2.40 b
2.24 b
2.15 b
2.14 b　1.51 b
1.90 b　0.70 b
1.51 b　0.23 b
0.79 b
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

CENTROID　BOW
STERN

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$
$C_X/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$

SHORT SINGAPORE IIc

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM
C_Δ
0.52
0.43
0.35
0.26
0.17

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

C_Δ　0.52
0.43　0.35　0.26　0.17
RESISTANCE

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

$C_M = 0$

TRIM ANGLE, DEG.

0.12
0.11
0.10
0.09
0.08
0.07
0.06　0.05　0.04　0.03　0.02
0.01

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4$ =

$\sqrt{C_R}/C_V$
$\sqrt{C_\Delta}/C_V$

0.35　　0.30　　0.25　　0.20　　0.15　　0.10　　0.05

Fig. 54   DESIGNATION: 3.73 - 4.09 - 26.0   NACA TN No. 1182

MODEL No. 73
MODEL BEAM: 12.00"

C.G.= 0.45 b FWD. OF STEP
       2.03 b ABOVE KEEL

C_{Δ_0} =   (NOMINAL)
k/L =

TESTED AT NACA No. 1 TANK
DATE: 10/36

FAIRED POINTED STEP

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V \frac{\rho}{2} b^4$ =

MODEL No. 74-A
MODEL BEAM: 15.92"

C.G.= 0.45 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)
0.93 b ABOVE KEEL   k/L=

TESTED AT NACA No.1 TANK
DATE : $^{10}/_{37}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID
BOW
STERN

$C_V^2/C_\Delta^{1/3}$

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ
0.8
0.7
0.6
0.5
0.4

C_Δ 0.8 0.7 0.6

RESISTANCE

C_Δ = 0.5 0.4

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

C_M = -0.1
0
+0.1
+0.2
+0.3
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04 0.03 0.02

0.05 0.04 0.03 0.02

FOREBODY CLEAR

STICKING

$\sqrt{C_R}/C_V$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 56

DESIGNATION: 2.87-2.44-20.0   NACA TN No. 1182

MODEL No. 75
MODEL BEAM: 15.9"

C.G.= 0.17 b FWD. OF CENTROID
0.98 b ABOVE KEEL

$C_{\Delta_0}=$
$k/L=$

(NOMINAL)

TESTED AT NACA No.I TANK
DATE: 10/37

FAIRED POINTED STEP

3.68 b
2.69 b
2.26 b
CHINE
1.48 b
1.13 b
0.57 b
0

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$
$C_X/C_\Delta^{1/3}$

CENTROID
STERN BOW

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.8
0.7
0.6
0.5
0.4

C_Δ
0.8
0.7
0.6
0.5
0.4

RESISTANCE

$C_R/C_V^2 \cdot C_\Delta^{2/3}$
$C_V^2/C_\Delta^{1/3}$
TRIM ANGLE, DEG.

$C_M =$ -0.1
0
+0.1

FOREBODY CLEAR

0.03 0.02

0.15 0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05 0.04 0.03 0.02
-0.2
-0.1

$\sqrt{C_R}/C_V$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

MODEL No. 83
MODEL BEAM 17.70"
C.G.= 0.42 b FWD. OF STEP
0.72 b ABOVE KEEL
C_{Δ_0} = (NOMINAL)
k/L =
TESTED AT NACA No.1 TANK
DATE: 1/40

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

LATÉCOÈRE 521

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.6
0.5
0.4
0.3

RESISTANCE

$C_R/C_V{}^2 C_\Delta{}^{2/3}$

$C_V{}^2/C_\Delta{}^{1/3}$

$\sqrt{C_R}/C_V$
0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.05 0.04 0.03 0.02

$C_M = 0$

STICKING

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

0.05
0.07
0.06

Fig. 58

DESIGNATION: 3.24 - 0.34 - 20.0 NACA TN No. 1182

MODEL No. 84-AF
MODEL BEAM: 15.92"

C.G.= 0.46 b FWD. OF CENTROID
1.16 b ABOVE KEEL

$C_{\Delta_0}=$
$k/L=$

(NOMINAL)

TESTED AT NACA No.I TANK
DATE: 3/39

$C_V/C_\Delta^{1/3}$
C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

CENTROID
STERN BOW
$C_X/C_\Delta^{1/3}$

3.67 b
3.82 b
2.09 b
2.96 b
1.70 b
2.54 b
1.13 b
0.56 b
1.99 b
0.85 b
BASE LINE
1.41 b

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.8
0.7
0.6

C_Δ
0.8
0.7
0.6
0.5
0.4

$C_R/C_V^2 C_\Delta^{2/3}$

0.5
0.4

0.5 0.4

RESISTANCE

0.8 0.7 0.6 0.5 0.4

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02

FOREBODY CLEAR

-0.1
$C_M=$ 0
+0.1

0.14
0.13
0.12
0.11
0.10
0.09
0.08

0.09

0.08

0.07
0.06
0.05
0.04 0.03

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05   0

MODEL No. 84-EF-1   C.G.= 0.46 b FWD. OF CENTROID $C_{\Delta_0}=$ (NOMINAL)   TESTED AT NACA No. 1 TANK
MODEL BEAM 15.92"   1.16 b ABOVE KEEL   k/L=   DATE: 3/39

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID

STERN   BOW

$C_X/C_\Delta^{1/3}$

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

RESISTANCE

C_Δ 0.8 0.7 0.6 0.5 0.4

C_Δ
0.8
0.7
0.6
0.5
0.4

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 60   DESIGNATION: 3.24 – 0.57 – 20.0 NACA TN No. 1182

MODEL No. 84-EF-3   C.G.= 0.46 b FWD. OF CENTROID $C_{\Delta_o}=$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM 15.92"   1.16 b ABOVE KEEL   k/L=   DATE: ³/₃₉

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

MODEL No. 84-EF-4   C.G.= 0.46 b FWD. OF CENTROID $C_{\Delta_o}=$ (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM· 15.92"   1.16 b ABOVE KEEL $k/L=$ DATE : 3/39

C_Z/C_Δ

$C_Y/C_\Delta{}^{1/3}$

$C_X/C_\Delta{}^{1/3}$

CENTROID

STERN

BOW

$C_V{}^2/C_\Delta{}^{1/3}$

3.82 b

2.09 b

2.96 b

1.70 b

1.13 b

2.54 b

0.56 b

1.98 b

0

0.85 b

BASE LINE

1.41 b

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

$C_R/C_V{}^2C_\Delta{}^{2/3}$

TRIM ANGLE, DEG.

C_Δ

0.8
0.7
0.6
0.5

0.4

0.5   0.4

C_Δ

0.8
0.7
0.6
0.5
0.4

RESISTANCE

$C_V{}^2/C_\Delta{}^{1/3}$

$C_M =$ -0.1
0
+0.1

0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04 0.03

$\sqrt{C_R}/C_V$

FOREBODY CLEAR

GETAWAY

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

MODEL No. 126 A-1
MODEL BEAM: 14.00"

C.G.= 0.31 b FWD. OF CENTROID $C_{\Delta_o} =$
      1.17 b ABOVE KEEL   k/L=

(NOMINAL)

TESTED AT NACA No. I TANK
DATE: 7/42

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID
STERN BOW

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

2.75b   2.50b   2.15b   2.21b   1.81b   1.22b   0.80b   1.79b   0.67b   0
BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ

$C_R/C_V^2 C_\Delta^{2/3}$

$C_\Delta = 1.2$
1.0
0.8
0.6

$C_\Delta = 1.2$

1.2
1.0
0.8
0.6

RESISTANCE

$C_\Delta = 1.2$ 1.0 0.8 0.6

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

$C_M = 0$
+0.2

0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08   0.07   0.06

0.06
-0.1
0.05
0.04
0.03

FOREBODY CLEAR

0.05   0.04   0.03

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 126 A-2   C.G.= 0.31 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM 14.00"   1.17 b ABOVE KEEL   k/L=   DATE: 7/42

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V^2 \frac{\rho}{2} b^4$ =

Fig. 64   DESIGNATION: 2.82 - 0.47 - 17.5   NACA TN No. 1182

MODEL No. 126 A-3
MODEL BEAM· 14.00"

C.G.= 0.31 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)
1.17 b ABOVE KEEL   k/L=

TESTED AT NACA No.1 TANK
DATE: 7/42

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4$ =

MODEL No. 126 B-1
MODEL BEAM: 14.00"

C.G.= 0.31 b FWD. OF CENTROID C_{Δ_0} =
      1.17 b ABOVE KEEL   k/L=

(NOMINAL)

TESTED AT NACA No. I TANK
DATE: 2/42

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
1.2
1.0
0.8
0.6

RESISTANCE

C_Δ=1.2 1.0 0.8 0.6

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4$ =

Fig. 66
DESIGNATION: 2.82 – 0.58 – 22.5 NACA TN No. 1182

MODEL No. 126B-2
MODEL BEAM 14.00"

C.G.= 0.31 b FWD. OF CENTROID
1.17 b ABOVE KEEL

$C_{\Delta_o} =$
k/L=

(NOMINAL)

TESTED AT NACA No. 1 TANK
DATE: ²/₄₂

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
1.2
1.0
0.8
0.6

C_Δ = 1.2
1.0

C_Δ = 0.8
0.6

RESISTANCE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4 =$

FOREBODY CLEAR

GETAWAY

NACA TN No. 1182   DESIGNATION: 2.82 - 0.47 - 22.5   Fig. 67

MODEL No. 126 B-3.   C.G. = 0.31 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM: 14.00"   1.17 b ABOVE KEEL   k/L =   DATE: 2/42

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE
$M_q / V \frac{\rho}{2} b^4$ =

MODEL No. 126 C-1
MODEL BEAM: 14.00"

C.G.= 0.31 b FWD. OF CENTROID C_{Δ_0}=
     1.17 b ABOVE KEEL k/L=

(NOMINAL)

TESTED AT NACA No. I TANK
DATE: 7/42

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

MODEL No. 126 C-2   C.G.= 0.31 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM: 14.00"   1.17 b ABOVE KEEL   k/L=   DATE: 7/42

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

C_Δ = 0.6
0.8
1.0
1.2

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V \frac{\rho}{2} b^4$ =

$\sqrt{C_R}/C_V$

$\sqrt{C_\Delta}/C_V$

$C_M = 0$

GETAWAY

Fig. 70 DESIGNATION: 2.82 – Q.47 – 27.5 NACA TN No. 1182

MODEL No. 126 C-3
MODEL BEAM: 14.00"

C.G.= 0.31 b FWD. OF CENTROID
1.17 b ABOVE KEEL

$C_{\Delta_0} =$ (NOMINAL)
$k/L =$

TESTED AT NACA No. I TANK
DATE: 7/42

C_Z/C_Δ

$C_Y'/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID
STERN ← → BOW

$C_X/C_\Delta^{1/3}$

2.75 b 2.50 b 2.21 b 1.81 b 1.22 b 0.80 b
1.79 b 2.15 b
0.57 b
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

TRIM

C_Δ
1.2
1.0
0.8
0.6

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ
1.2
1.0
0.8
0.6

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$C_M = +0.2$

TRIM ANGLE, DEG.

0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04 0.03

$\sqrt{C_R}/C_V$

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35 0.30 0.25 0.20 0.15 0.10 0.05

MODEL No. 144   C.G.= 0.45 b FWD. OF STEP C_{Δ_o} =   (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM· 15.92   1.13 b ABOVE KEEL   k/L =   DATE: 7-42

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V\frac{\rho}{2}b^4$ =

Fig. 72
DESIGNATION: 3.94-0.85-20.0   NACA TN No. 1182

MODEL No. 145
MODEL BEAM: 14.24
C.G.= 0.51 b FWD. OF STEP
1.26 b ABOVE KEEL
$C_{\Delta_0} =$ (NOMINAL)
$k/L =$
TESTED AT NACA No. 1 TANK
DATE: 7-42

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_\Delta = 0.95$
0.70
0.55

TRIM

RESISTANCE

FROM SPECIFIC TESTS LOADS APPROXIMATE

$C_\Delta = 0.95$ 0.70   0.55

$C_V^2 / C_\Delta^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\ell}{2} b^4 =$

$\sqrt{C_R}/C_V$

$\sqrt{C_\Delta}/C_V$

$C_M = 0$ 0.13   0.12   0.11   0.10   0.09   0.08   0.07   0.06   0.05   0.04   0.03   0.02

GETAWAY

MODEL No. 146   C.G.= 0.55 b FWD. OF STEP $C_{\Delta_0} =$ (NOMINAL)   TESTED AT NACA No.1 TANK
MODEL BEAM: 13.00"   1.38 b ABOVE KEEL $k/L =$ DATE: 7-42

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

FROM SPECIFIC TESTS, LOADS APPROXIMATE

TRIM

$C_\Delta = 1.2$
0.9
0.7

RESISTANCE

$C_\Delta = 1.2$
0.9   0.7

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

$C_M = 0$

GETAWAY

MODEL No. 184
MODEL BEAM· 11.81"
C.G.= 0.46 b FWD. OF CENTROID C_{Δ_o} =   (NOMINAL)
1.40b ABOVE KEEL   k/L=

TESTED AT NACA No. I TANK
DATE : '44

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$
$C_X/C_\Delta^{1/3}$

CENTROID
STERN BOW

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

4.35b
3.26b
5.06b
2.18b
4.35b
2.90b
1.09b
1.45b
0
BASE LINE
0

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

C_Δ = 4.0
3.5
3.0
2.5
2.0
1.5
1.0

RESISTANCE

C_Δ = 3.5 3.0 2.5 2.0 1.5 1.0

TRIM ANGLE, DEG.

C_Δ = 1.0
1.5
4.0
3.0
2.5 2.0
1.5

$C_V^2/C_\Delta^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V \frac{\rho}{2} b^4$ =

C_M = 0

FOREBODY CLEAR
0.08 0.07 0.06 0.05 0.04 0.03 0.02

TRIM ANGLE, DEG.
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10

$\sqrt{C_R}/C_V$

0.09 0.08 0.07 0.06 0.05

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 185   C.G.= 0.46 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT NACA No. I TANK
MODEL BEAM: 11.81"   1.40 b ABOVE KEEL   k/L=   DATE : '44

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4 =$

Fig. 76   DESIGNATION: 5.80 - 1.22 - 24.5 NACA TN No. 1182

MODEL No. 185-A
MODEL BEAM: 11.81"

C.G.= 0.46 b FWD. OF CENTROID $C_{\Delta_0} =$ (NOMINAL)
1.40 b ABOVE KEEL   k/L=

TESTED AT NACA No.1 TANK
DATE: 1/44

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

CENTROID
STERN   BOW
BASE LINE

4.35b   3.26b   5.06b   2.18b   4.35b   2.90b   1.09b   1.45b   0   0

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
3.5
3.0
2.5
2.0
1.5
1.0

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ 1.0 1.5

C_Δ 3.5 3.0 2.5 2.0 1.5 1.0

C_Δ 4.0 3.5 3.0 2.5 2.0

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02

FOREBODY CLEAR

$C_M = 0$

0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10

TRIM ANGLE, DEG.

0.09 0.08 0.07 0.06 0.05

0.04

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

GETAWAY

MODEL NO. 207   C.G.= 0.31 b FWD. OF CENTROID C_{Δ_0} = 0.67 (NOMINAL)   TESTED AT N.A.C.A. No.1 TANK
MODEL BEAM 14.74"   0.83b ABOVE KEEL   k/L=   DATE : 12-44

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE
FROM SPECIFIC TESTS, LOADS APPROXIMATE

TRIM

C_Δ = 0.70

0.60

C_Δ = 0.60
0.50

RESISTANCE

C_M = 0

0.12

$\sqrt{C_R}/C_V$ = 0.11

0.10

0.09

0.08

0.07

0.06   0.05   0.04   0.03

0.02

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\rho}{2} b^4$ =

$\sqrt{C_\Delta}/C_V$

Fig. 78   DESIGNATION: 3.78-1.06-25.0   NACA TN No. 1182

MODEL No. 207A   C.G.= 0.31b FWD. OF CENTROID C_{Δ_0} = 0.67 (NOMINAL)   TESTED AT N.A.C.A. No.1 TANK
MODEL BEAM 14.74"   0.83b ABOVE KEEL k/L =   DATE: 12-44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

DISTANCE FROM ℄
$C_Y/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL
C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE
FROM SPECIFIC TESTS, LOADS APPROXIMATE

TRIM

C_Δ =
0.60
0.50

C_Δ = 0.70

0.60

RESISTANCE

$C_R/C_V^2 C_\Delta^{2/3}$

$C_V^2/C_\Delta^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 = 0.118$

$C_M = 0$

0.12

UPPER LIMIT

$\sqrt{C_R}/C_V = 0.11$
0.10
0.09
0.08
0.07
0.06 0.05 0.04   0.03 0.02
0.01

LOWER LIMIT
$\sqrt{C_\Delta}/C_V$

GETAWAY

MODEL No. 207 C
MODEL BEAM: 14.74"

C.G.= 0.31 b FWD. OF CENTROID C_{Δ_o} =
0.83b ABOVE KEEL k/L=   (NOMINAL)

TESTED AT NACA No.1 TANK
DATE: 9/45

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

C_Z/C_Δ

HEIGHT ABOVE KEEL
C_Z/C_Δ

DISTANCE FROM ℄
$C_Y/C_\Delta^{1/3}$

$C_Y/C_\Delta^{1/3}$

CENTROID

STERN BOW

$C_X/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

3.65 b
3.71 b
3.07 b
2.49 b
3.39 b
1.91 b
3.30 b
1.33 b
0.78 b
0.18 b
0.72 b
2.43 b
1.56 b
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE
FROM SPECIFIC TESTS, LOADS APPROXIMATE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM C_Δ
        0.60
        0.50

$C_\Delta = 0.70$

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V^2\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 80   DESIGNATION: 2.31-0.38-20.0   NACA TN No. 1182

MODEL NO. L/b-5.5
MODEL BEAM: 10.92"

C.G.= 0.18 b FWD. OF STEP
1.11 b ABOVE KEEL

$C_{\Delta_o} =$ (NOMINAL)
$k/L =$

TESTED AT RAE TANK
DATE: 5-35

$\frac{C_Z}{C_\Delta}$

$C_V/C_\Delta^{1/3}$

$C_X/C_\Delta^{1/3}$

STERN — BOW

STEP

$C_V^2/C_\Delta^{1/3}$

2.64b
2.16b
2.39b
0.98b
2.03b
1.76b
1.21b
0.06
0.06
0.06

BASE LINE

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

$C_\Delta = 0.37$
0.32
0.27
0.21

$\frac{C_R}{C_V^2 C_\Delta^{2/3}}$

0.32, 0.27
$C_\Delta = 0.37$
0.21

RESISTANCE

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10 0.09 0.08
0.07
0.06
0.05
0.04
0.03

TRIM ANGLE, DEG.

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V \frac{\rho}{2} b^4 =$

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. L/b·7.0   C.G.= 0.23 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM: 8.56"   1.42 b ABOVE KEEL   k/L=   DATE: 9-35

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

TRIM

C_Δ
0.77
0.66
0.55
0.44

RESISTANCE

C_Δ·0.77
0.55   0.66

$C_R/C_V{}^2 C_\Delta{}^{2/3}$

$C_V{}^2/C_\Delta{}^{1/3}$

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_V$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q / V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

TRIM ANGLE, DEG.

GETAWAY

Fig 82   DESIGNATION: 3.57 - 0.58 - 20.0   NACA TN No. 1182

MODEL No. L/b=8.5   C.G.= 0.28 b FWD. OF STEP   C₄₀ =   (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM: 7.06"   1.72 b ABOVE KEEL   k/L=   DATE: 1-36

C_Z/C_Δ

$C_V/C_\Delta^{1/3}$

STEP

STERN BOW

$C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

RESISTANCE

TRIM ANGLE, DEG.

C_Δ
1.38
1.18
0.99
0.79

1.18-1.38

C_Δ· 0.99

0.79

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

MODEL No. L/b=10.0   C.G.= 0.32 b FWD. OF STEP C_{Δ_0} =   (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM: 6.00"   2.02 b ABOVE KEEL k/L =   DATE: 5-36

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

RESISTANCE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q / V \frac{\ell}{2} b^4$ =

Fig. 84

MODEL No.

MODEL BEAM: 717"

C.G. = 0.24 b FWD. OF STEP
1.32 b ABOVE KEEL

C_{Δ_o} = 1.28 (NOMINAL)

k/L = 0.228

TESTED AT R.A.E. TANK

DATE: 2/42

FAIRED STEP

4.00b
3.86b
3.48b
3.71b
3.17b
3.14b
2.72b
2.26b
2.28b
1.36b
1.416b
0.45b
0.11b
0.19b
0.05b

BASE LINE

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

C_z/C_Δ

$C_v/C_\Delta^{1/3}$

$C_x/C_\Delta^{1/3}$

STEP

STERN — BOW

$C_v^2/C_\Delta^{1/3}$

SHORT SHETLAND

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE.

$C_R/C_v^2 C_\Delta^{2/3}$

TRIM

C_Δ = 1.50
1.30
1.20
0.90

C_Δ = 1.50
1.20
0.90

RESISTANCE

TRIM ANGLE, DEG.

$C_v^2/C_\Delta^{1/3}$

UPPER LIMIT

TRIM ANGLE, DEG.

$\sqrt{C_R}/C_v$ = 0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02

GETAWAY

LOWER LIMIT

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4$ = 0.36

$\sqrt{C_\Delta}/C_v$

MODEL No. N2/42-AI   C.G.= 0.16 b FWD. OF CENTROID C_{Δ_0} = 1.35   (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM: 6.64"   1.92 b ABOVE KEEL   k/L= 0.218   DATE: '43

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

FROM SPECIFIC TESTS, LOADS APPROXIMATE

RESISTANCE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q \big/ V \frac{\rho}{2} b^4 = 0.101$

UPPER LIMIT

LOWER LIMIT

GETAWAY

Fig. 86

DESIGNATION: 2.87-1.11-20.0   NACA TN No. 1182

MODEL No. N2/42-Q   C.G.= 0.16 b FWD. OF CENTROID C_{Δ_0} = 1.40   (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM 6.56"   1.95 b ABOVE KEEL   k/L= 0.218   DATE '43

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

CENTROID — STERN BOW — $C_X/C_\Delta^{1/3}$

FAIRED TRANSVERSE STOP

2.65 b   3.53 b   2.56 b
2.26 b
1.91 b   1.83 b
1.11 b
1.56 b   0.38 b
0.82 b   1.18 b   0.18 b

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ 1.20

C_Δ 1.00

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ 1.20

FROM SPECIFIC TESTS, LOADS APPROXIMATE

RESISTANCE C_Δ 1.00

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

$C_M = 0$ $\sqrt{C_R}/C_V$

0.18 0.17 0.16 0.15 0.14 0.13 0.12 0.11 0.10 0.09 0.08 0.07 0.06 0.05   UPPER LIMIT

0.04

TRIM ANGLE, DEG.

LOWER LIMIT

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 = 0.106$ $\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

GETAWAY

MODEL No. OEH
MODEL BEAM· 6.58"

C.G.= 0.10 b FWD. OF CENTROID C_{Δ_o} = 1.65   (NOMINAL)
1.29 b ABOVE KEEL   k/L=

TESTED AT RAE TANK
DATE: ²/45

FULLY FAIRED STEP

CENTROID

STERN ← BOW →

4.33 b
3.69 b
2.72 b
1.77 b
3.17 b
2.69 b
2.21 b
1.72 b
1.29 b
1.08 b
0.81 b
0.55 b
0.05 b

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

C_Z/C_Δ
$C_Y/C_\Delta^{1/3}$
$C_X/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

FROM SPECIFIC TESTS, LOADS APPROXIMATE

C_Δ
1.60
1.30

TRIM

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ = 1.60

C_Δ = 1.30   1.00

RESISTANCE

C_Δ
1.30
0.80

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

$\bar{C}_M$ 0

FOREBODY CLEAR
0.05
0.04
0.03
0.02

0.15
0.14
0.13   0.12   0.11   0.10
0.09
0.08
0.07
$\sqrt{C_R}/C_V$
0.06   0.05

0.03

0.04

TRIM ANGLE, DEG.

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V_{\frac{\rho}{2}}^{}b^4$ = 0.395

$\sqrt{C_\Delta}/C_V$

0.35   0.30   0.25   0.20   0.15   0.10   0.05

Fig. 88   DESIGNATION: 4.02–1.09–27.5 NACA TN No. 1182

MODEL No. FEH   C.G.= 0.10 b FWD. OF CENTROID C_{Δ_o}= 1.65 (NOMINAL)   TESTED AT RAE TANK
MODEL BEAM: 6.58"   1.29 b ABOVE KEEL   k/L=   DATE: 2/45

STATION SPACING GIVEN AS DISTANCE FROM CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

FROM SPECIFIC TESTS. LOADS APPROXIMATE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 = 0.395$

MODEL No. 294-79   C.G.= 0.44 b FWD. OF CENTROID C_{Δ_0} = 1.02 (NOMINAL)   TESTED AT SIT No.I TANK
MODEL BEAM 5.10"   1.22 b ABOVE KEEL   k/L=   DATE 5/42

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM ₵
$C_Y/C_\Delta^{1/3}$

CENTROID

HEIGHT ABOVE KEEL
C_Z/C_Δ

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

NACA TESTS
5/45

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

MARTIN PBM-1

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ

1.10
1.0
0.9
0.8

TRIM

C_Δ
1.1
1.0
0.9
0.8

RESISTANCE

MARTIN TESTS
5/42

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

MARTIN TESTS
5/42

C_M

-0.15
0

0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08

0.07

UPPER LIMIT

$\sqrt{C_R}/C_V$

0.06
0.05 0.04
0.03

LOWER LIMIT

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 = 0.284$

$\sqrt{C_\Delta}/C_V$

TRIM ANGLE, DEG.

Fig. 90

DESIGNATION: 3.32-0.62-20.0   NACA TN No. 1182

MODEL NO. 339-1
MODEL BEAM: 5.40"

C.G.= 0.35 b FWD. OF STEP
0.90b ABOVE KEEL

C_{A_0} = 1.069 (NOMINAL)
k/L = 0.225

TESTED AT S.I.T. NO.1 TANK
DATE: 11-4-43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM $\mathfrak{C}$, $C_Y/C_A^{1/3}$

HEIGHT ABOVE KEEL, C_Z/C_A

LONGITUDINAL POSITION
FROM STEP, $C_X/C_A^{1/3}$

$C_V^2/C_A^{1/3}$

STEP BOW
STERN BOW
$C_X/C_A^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

BASE LINE

MARTIN XPB2M-1

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_A = 1.40
1.20
1.00
0.80
0.60

C_A = 1.40
1.20
1.00
0.80

RESISTANCE   0.60

$C_R/C_V^2C_A^{2/3}$

$C_V^2/C_A^{1/3}$

TRIM ANGLE, DEG.

C_M =
-0.30
0.0
+0.30

0.08 0.07   0.06   UPPER LIMIT
0.05   0.04

0.03 C_M =
-0.30

0.16 0.15 0.14 0.13 0.12 0.11 0.10
0.09
$\sqrt{C_R}/C_V$
LOWER LIMIT   0.08
0.15
-0.075
0.0

0.07

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\ell}{2}b^4$ = 0.25

$\sqrt{C_A}/C_V$

+0.075
+0.15

+0.30 0.05 0.04

TRIM ANGLE, DEG.

GETAWAY

MODEL No. 339-15　　　C.G.＝ 0.35b FWD. OF STEP　　　C_{Δ_0} ＝　(NOMINAL)　　　TESTED AT SIT No. 1 TANK
MODEL BEAM· 5.40　　　　　　0.90b ABOVE KEEL　　　k/L＝　　　　　　　　　DATE· 5-13-44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM $\mathcal{C}$, $C_Y/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL, C_Z/C_Δ

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

$C_\Delta = 1.40$

1.20
1.00
0.80
0.60

$C_R/C_V^2 C_\Delta^{2/3}$

1.40
1.20
1.00

0.80

0.60

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\ell}{2}b^4$ ＝

$\sqrt{C_\Delta}/C_V$

0.35　　0.30　　0.25　　0.20　　0.15　　0.10　　0.05

GETAWAY

Fig. 92 — DESIGNATION: 2.72-0.62-20.0 NACA TN No. 1182

MODEL No. 339-20
MODEL BEAM: 5.40"
C.G.= 0.35 b FWD. OF STEP
0.90 b ABOVE KEEL
C_{Δ_o} = (NOMINAL)
k/L =
TESTED AT SIT No I TANK
DATE: 5-13-44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM ₵, $C_Y/C_\Delta^{1/3}$
HEIGHT ABOVE KEEL, C_Z/C_Δ
LONGITUDINAL POSITION FROM STEP, $C_X/C_\Delta^{1/3}$
$C_V^2/C_\Delta^{1/3}$

STEP — STERN BOW — $C_X/C_\Delta^{1/3}$

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM
2.67 b, 2.19 b, 2.23 b, 1.45 b, 1.33 b, 0.72 b, 0.0 b, 0.0 b
BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM
C_Δ·0.80
0.60
0.40

$C_R/C_V^2 C_\Delta^{2/3}$

RESISTANCE
C_Δ·0.80 0.60 0.40

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =
$\sqrt{C_\Delta}/C_V$

TRIM ANGLE, DEG.

GETAWAY

MODEL No. 339-22   C.G.= 0.35b FWD. OF STEP C_{Δ_0} = 0.588 (NOMINAL)   TESTED AT S.I.T. No.1 TANK

MODEL BEAM: 5.40"   0.90b ABOVE KEEL   k/L= 0.225   DATE: 11-4-43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM $\bar{C}$, $C_Y/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL, C_Z/C_Δ

LONGITUDINAL POSITION FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM DISPLACEMENT RANGE

TRIM C_Δ=0.80 0.70 0.60 0.50 0.40 0.30

C_Δ = 0.80 0.70 0.60

0.50 0.40 0.30

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS PLANING RANGE

$M_q/V_{\frac{1}{2}}^\ell b^4 = 0.25$

C_M= -0.30 0.0 +0.15

0.70   0.60   0.50

UPPER LIMIT

$\sqrt{C_R}/C_V$

0.14 0.13 0.12 0.11 0.10

LOWER LIMIT 0.09

0.08

0.07

0.06

0.05

$\sqrt{C_\Delta}/C_V$

C_M= -0.30 -0.15 -0.075 0.0 +0.04 +0.075 +0.15 +0.30

Fig. 94 DESIGNATION: 3.93-0.64-20.0 NACA TN No. 1182

MODEL No. 339-23
MODEL BEAM: 5.40"
C.G.= 0.35b FWD. OF STEP
0.90b ABOVE KEEL
C_{Δ_o} = 1.770 (NOMINAL)
k/L = 0.225
TESTED AT S.I.T. No. I TANK
DATE: 11-4-43

MODEL No. 339-46   C.G.= 0.35b FWD. OF STEP C_{Δ_o} = 2.722 (NOMINAL)   TESTED AT S.I.T. No. I TANK
MODEL BEAM: 5.40"   0.90b ABOVE KEEL   k/L= 0.225   DATE: 11-4-43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

STATION SPACING GIVEN AS
DISTANCE FROM
STEP, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =0.25

Fig. 96
DESIGNATION: 3.93-0.67-20.0   NACA TN No. 1182

Model No. 339-49
Model Beam: 5.40"

C.G. = 0.35 b FWD. OF STEP
0.90b ABOVE KEEL

C_{Δ_0} = (NOMINAL)
k/L =

Tested at SIT No. 1 Tank
Date: 5-13-44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM $\mathcal{C}$, $C_Y/C_\Delta^{1/3}$

STEP BOW

STERN BOW

$C_X/C_\Delta^{1/3}$

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

LONGITUDINAL POSITION FROM STEP, $C_X/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL, C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

STATION SPACING GIVEN AS DISTANCE FROM STEP, IN UNITS OF BEAM

3.03b
1.82b
3.14b
2.09b
1.04b
0.0b
0.0b
BASE LINE

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ = 2.00
1.60
1.40
1.20
1.00
0.80

$C_M/C_V^2 C_\Delta^{2/3}$

TRIM ANGLE, DEG.

0.80   1.00
C_Δ = 2.00
1.60
1.40
1.20, 1.00, 0.80

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

GETAWAY

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{1}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

MODEL No. 439-1
MODEL BEAM: 5.40"

C.G.= 0.43 b FWD. OF CENTROID C_{Δ_0} = 0.90   (NOMINAL)
0.90 b ABOVE KEEL   k/L =

TESTED AT SIT No.1 TANK
DATE: 3/43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

DISTANCE FROM ₵
$C_Y/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL
C_Z/C_Δ

CENTROID

STERN BOW

$C_X/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

1.33 b
1.74 b
2.22 b
2.44 b
2.67 b
3.26 b
3.19 b
3.00 b
2.67 b
2.22 b
1.78 b
1.33 b
0.67 b
0

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$C_R/C_V^2 C_\Delta^{2/3}$

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 98   DESIGNATION: 3.32-0.62-10.0   NACA TN No. 1182

MODEL No. 439-2   C.G.= 0.43 b FWD. OF CENTROID C_{δ_o} = 0.90   (NOMINAL)   TESTED AT SIT No. I TANK
MODEL BEAM: 5.40"   0.90 b ABOVE KEEL   k/L=   DATE: 3/43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

DISTANCE FROM ₵
$C_Y/C_\Delta^{1/3}$

CENTROID

STERN   BOW

$C_X/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL
C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

1.33 b   1.74 b   2.22 b   2.44 b   2.67 b

3.99 b
3.00 b
2.67 b
2.22 b
1.78 b
1.33 b
0.67 b

BASE LINE   0

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

MODEL No. 439-3   C.G.= 0.43 b FWD. OF CENTROID C_{Δ_0} = 0.90   (NOMINAL)   TESTED AT SIT No.1 TANK
MODEL BEAM: 5.40"   0.90 b ABOVE KEEL   k/L=   DATE: 3/43

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM ℄
$C_Y/C_\Delta^{1/3}$

C_Δ = 0.4 ONLY

CENTROID

HEIGHT ABOVE KEEL
C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

BASE LINE

1.33 b   1.74 b   2.22 b   2.44 b   2.67 b   3/9 b   3.00 b   2.67 b   2.22 b   1.78 b   1.33 b   0   0.67 b

$C_R/C_V^2 C_\Delta^{2/3}$

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4$ =

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 100

DESIGNATION: 3.28 − 0.59 − 20.0 NACA TN No. 1182

MODEL No. 406
MODEL BEAM: 5.45

C.G.= 0.37 b FWD. OF CENTROID
1.10 b ABOVE KEEL

$C_{\Delta_0} = 0.73$ (NOMINAL)
k/L=

TESTED AT SIT No. I TANK
DATE: 3/42

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

DISTANCE FROM ₵
$C_Y/C_\Delta^{1/3}$

CENTROID BOW

STERN

HEIGHT ABOVE KEEL
C_Z/C_Δ

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

NACA TESTS
5/45

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

BASE LINE

MARTIN PBM-3

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

TRIM

C_Δ
0.8
0.7
0.6

$C_R/C_V^2 C_\Delta^{2/3}$

C_Δ
0.9
0.8
0.7
0.6

C_Δ
0.8
0.7
0.6

MARTIN TESTS
3/42

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 = 0.159$

TRIM ANGLE, DEG.

UPPER LIMIT

MARTIN TESTS
3/42

−0.05
$C_M = 0$

0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07

$\sqrt{C_R}/C_V$

0.05

0.03

LOWER LIMIT

0.06
0.05
0.04

GETAWAY

$\sqrt{C_\Delta}/C_V$

MODEL No. 618-1
MODEL BEAM: 5.40"

C.G.= 0.39 b FWD. OF CENTROID
       1.05 b ABOVE KEEL

$C_{\Delta_0}=$ (NOMINAL)
$k/L=$

TESTED AT SIT No.1 TANK
DATE: 9/44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$\phi=5°$ $\phi=0°$

HEIGHT ABOVE KEEL
C_Z/C_Δ

CENTROID

STERN   BOW

$C_X/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

$C_V^2/C_\Delta^{1/3}$

45° V - STEP

2.77 b
2.44 b
2.04 b
3.17 b
3.02 b
2.78 b
1.71 b
1.19 b
2.50 b
0.14 b
0.66 b
2.83 b
1.97 b
1.44 b
0.91 b
BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_\Delta=0.69$

$C_R/C_V^2 C_\Delta^{2/3}$

TRIM

FROM SPECIFIC TESTS, LOADS APPROXIMATE

$C_\Delta=0.62$

RESISTANCE

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

Fig. 102   DESIGNATION: 3.36-0.87-20.0   NACA TN No. 1182

MODEL No. 621-2
MODEL BEAM: 5.40"

C.G.= 0.40 b FWD. OF CENTROID $C_{\Delta_0} =$ (NOMINAL)
1.05 b ABOVE KEEL $k/L =$

TESTED AT SIT No. I TANK
DATE: 10/44

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

C_Z/C_Δ

$C_Y/C_\Delta^{1/3}$

$\Phi = 5°$

$\Phi = 0°$

CENTROID

STERN BOW

$C_X/C_\Delta^{1/3}$

LONGITUDINAL POSITION
FROM STEP, $C_X/C_\Delta^{1/3}$

HEIGHT ABOVE KEEL
C_Z/C_Δ

$C_V^2/C_\Delta^{1/3}$

BASE LINE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE

$C_R/C_V^2 C_\Delta^{2/3}$

$C_\Delta = 0.8$

$C_\Delta = 0.7$

TRIM

TRIM ANGLE, DEG.

$C_V^2/C_\Delta^{1/3}$

TRIM ANGLE, DEG.

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE

$M_q/V\frac{\rho}{2}b^4 =$

$\sqrt{C_\Delta}/C_V$

GETAWAY

0.35   0.30   0.25   0.20   0.15   0.10   0.05

MODEL No. 621-8   C.G.=   0.40 b FWD. OF CENTROID C_{Δ_0} =   (NOMINAL)   TESTED AT SIT No. I TANK
MODEL BEAM: 5.40"   1.05 b ABOVE KEEL   k/L=   DATE: 1/45

LOCATIONS OF TANGENCIES OF FOREBODY SPRAY BLISTER ENVELOPES
FREE-TO-TRIM, DISPLACEMENT RANGE

STATION SPACING GIVEN AS
DISTANCE FROM
CENTROID, IN UNITS OF BEAM

FREE-TO-TRIM RESISTANCE AND TRIM
DISPLACEMENT RANGE
FROM SPECIFIC TESTS, LOADS APPROXIMATE

RESISTANCE, MOMENT AND STABILITY CHARACTERISTICS
PLANING RANGE
$$M_q / V\frac{\rho}{2}b^4 =$$